

Chapter 7. Habitat Conservation Measures

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7. Habitat Conservation Measures

7.1 Introduction

To address the habitat impacts of the City's water supply system, the City developed the conservation strategy described in Chapter 2. Chapter 6 translated the conservation strategy into species-specific goals and objectives. Measures to accomplish the goals and objectives are described in this chapter.

To provide context for the measures, the impacts the City has had, or could have, in the Bull Run River are briefly summarized in Table 7-1 as they might affect groupings of species addressed or covered by this HCP. Table 7-1 also briefly introduces the habitat conservation measures and associates them with the impacts the measures are intended to address. The biological effects expected to result from implementing the measures are described in Chapter 8.

Table 7-1. Summary of Potential Water Supply System Impacts and Associated Habitat Conservation Measures in the Bull Run River, by Species Grouping

Species ^a	Potential Impacts of Water Supply System ^b	Habitat Conservation Measures ^c
<i>Anadromous Fish</i>		
Fall Chinook	<ul style="list-style-type: none"> Reduced flow 	<ul style="list-style-type: none"> Provide flow in lower Bull Run River
Spring Chinook	<ul style="list-style-type: none"> Flow fluctuations 	<ul style="list-style-type: none"> Avoid effects on flow in Little Sandy River (lower Bull Run tributary)
Coho	<ul style="list-style-type: none"> Reduced water quality 	<ul style="list-style-type: none"> Add summer season flow in Cedar Creek
Winter Steelhead	<ul style="list-style-type: none"> Depleted spawning gravel 	<ul style="list-style-type: none"> Manage flow fluctuations in lower Bull Run River
Chum	<ul style="list-style-type: none"> Loss of riparian habitat 	<ul style="list-style-type: none"> Manage water temperatures in lower Bull Run River
Eulachon	<ul style="list-style-type: none"> Reduced instream habitat complexity 	<ul style="list-style-type: none"> Augment spawning gravel in lower Bull Run River
Lamprey (Pacific, River and Western Brook)	<ul style="list-style-type: none"> Blocked access to spawning and rearing habitat at dams and culverts 	<ul style="list-style-type: none"> Protect riparian habitat on City land along lower Bull Run River Manage water supply operations and maintenance activities to avoid or minimize effects Protect and enhance riparian habitat in other Sandy River Basin reaches Increase instream habitat complexity in other Sandy River Basin reaches Provide passage at current culvert on Walker Creek (lower Bull Run tributary) Provide passage at current blockages on Alder Creek and Cedar Creek

Table continued on next page.

Table 7-1. Summary of Potential Water Supply System Impacts and Associated Habitat Conservation Measures in the Bull Run River Watershed, by Species Grouping, continued

Species^a	Potential Impacts of Water Supply System^b	Habitat Conservation Measures^c
<i>Resident Fish</i>		
Cutthroat Trout Rainbow Trout	<ul style="list-style-type: none"> • Loss of habitat due to reservoir operations • Seasonal stranding in Dam 2 spillway approach canal 	<ul style="list-style-type: none"> • Protect habitat by maintaining current limitations on reservoir operations (e.g. surface elevations during spring season tributary spawning) • Rescue stranded fish and return them to reservoir • Manage water supply operations and maintenance activities to avoid or minimize effects
<i>Amphibians and Reptiles</i>		
Salamanders (Cope's Giant, Cascade Torrent, Clouded, Oregon Slender)	<ul style="list-style-type: none"> • Temporary habitat disturbance • Potential loss of habitat in riparian zones 	<ul style="list-style-type: none"> • Control reed canarygrass on bench at upper end of Reservoir 1 • Survey for presence of turtles and avoid impacts during implementation of habitat conservation measures proposed near the mouth of the Sandy River
Frogs (Coastal Tailed, Northern Red-legged, Cascade)		<ul style="list-style-type: none"> • Protect riparian forests on City land along lower Bull Run River
Western Toad		<ul style="list-style-type: none"> • Manage water supply operations and maintenance activities to avoid or minimize effects
Turtles (Western Painted, Northwestern Pond)		<ul style="list-style-type: none"> • Protect and enhance riparian forests along other Sandy River Basin reaches
<i>Birds</i>		
Bald Eagle ^d Northern Spotted Owl	<ul style="list-style-type: none"> • Temporary noise disturbance • Loss of nesting habitat • Loss of roosting habitat 	<ul style="list-style-type: none"> • Avoid noise-generating activities (e.g., road brushing) during nesting season • Avoid cutting nest trees • Avoid cutting roost trees • Manage water supply operations and maintenance activities to avoid or minimize effects

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Table 7-1. Summary of Potential Water Supply System Impacts and Associated Habitat Conservation Measures in the Bull Run River Watershed, by Species Grouping, continued

Species ^a	Potential Impacts of Water Supply System ^b	Habitat Conservation Measures ^c
<i>Mammals</i>		
Fisher	<ul style="list-style-type: none"> • Temporary habitat disturbance • Loss of habitat 	Consult with USFWS about necessary additional measures if fishers recolonize Bull Run watershed, or recolonize locations in the Sandy River Basin where City is implementing habitat conservation measures

^aThe six covered fish species are listed in bold type; all other species are addressed by, but not covered by, this HCP. Fall and spring Chinook are separate races of the same species (*O. tshawytscha*). In this HCP, the City refers to them as two species. Fall and spring Chinook, steelhead, and coho are therefore referred to as the four primary covered species.

^bThis list is not comprehensive; see additional information in Chapters 2 and 8 and the discussion of limiting factors in Chapters 5 and 8.

^cThis list is not comprehensive; see additional details below in this chapter and in Chapter 8.

^dAlthough the bald eagle has been delisted as a threatened species on the Endangered Species List, the City has prepared its bald eagle measure according to the National Bald Eagle Management Guidelines (U.S. Fish and Wildlife Service 2007b).

For each measure, the intended enforceable terms are described in the boxed text, and include the referenced tables. Unless otherwise indicated, the habitat conservation measures will be implemented (annually or continuously, as applicable) for the 50-year term of the HCP.

Habitat conservation measures for the lower Bull Run River are described in Sections 7.2 and 7.3, and include measures for the Bull Run reservoirs. Measures related to operating and maintaining the water supply infrastructure are described in Section 7.4. Habitat conservation measures in the larger Sandy River Basin (referred to as “offsite” measures) are presented in Section 7.5. The Habitat Fund discussed in Section 7.6 is designed to implement additional projects in the Sandy River Basin to meet the City’s conservation responsibilities. Section 7.7 describes measures provided to protect terrestrial wildlife, in the Bull Run watershed and for other covered activities where applicable. Summary tables are provided for each section.

7.2 Lower Bull Run River Habitat Conservation Measures

The City’s direct impacts on fish and fish habitat occur in the lower Bull Run River. The impacts are in three general categories: river flow, water temperature, and habitat (e.g., spawning gravel). To address these impacts, the City will implement measures to avoid or minimize flow and temperature impacts, and measures to protect and improve both instream and riparian habitat. The effects of implementing these measures are described in Chapter 8 and Appendix E for each species.

The HCP Objectives described in Chapter 6 were used to identify habitat conservation measures for the lower Bull Run River. These objectives are as follows:

- Provide instream flows in the lower Bull Run River to improve existing conditions for the four primary covered fish species
- Provide water temperature conditions in the lower Bull Run River that are equivalent to natural pre- water-system conditions and in compliance with the Sandy River Basin Total Maximum Daily Load (TMDL) and temperature management plan
- Improve instream habitat conditions in the lower Bull Run River
- Protect riparian forest conditions on City land along the lower Bull Run River
- Ensure access for fish into lower Bull Run River tributaries
- Avoid or minimize periodic temporary disturbance of habitat (for species covered or addressed in the HCP) that might otherwise result from routine operation, maintenance, repair of water supply facilities, or incidental land management
- Avoid or minimize periodic temporary disturbance of habitat (for species covered or addressed in the HCP) that might otherwise result from implementation of the HCP habitat conservation measures
- Protect instream flows in the Little Sandy River

Figure 7-1 is a map of the lower Bull Run River area marked with the major landscape and structural features that are pertinent to implementing the Bull Run measures.

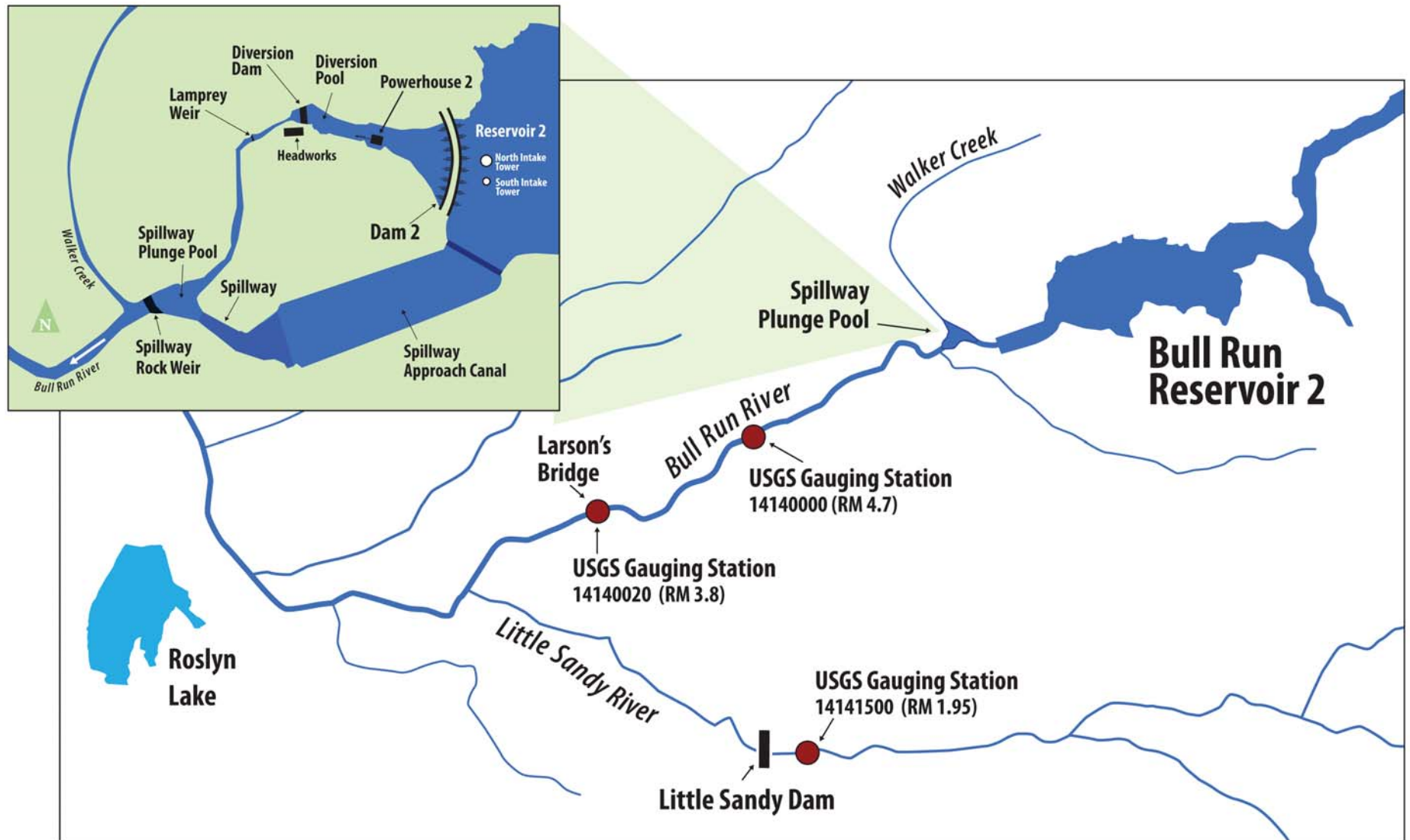


Figure 7-1. The Lower Bull Run River and Surrounding Area

Note: Map not to scale

7.2.1 Instream Flow Measures in the Lower Bull Run River

Estimates of natural, pre-water-system flows in the lower Bull Run River are shown in Table 4-5 in Chapter 4. These flows provided passage upstream for adult steelhead, salmon, and other aquatic species and created pools, riffles, and runs that rearing and migrating fish used. The natural flow conditions also tended to result in gradual rises and drops in river levels.

The City has gathered data and conducted modeling to estimate the relationship between flow and total usable habitat for salmon and steelhead, and has contrasted those results with natural streamflow conditions. A flow regime was developed to regulate the amount and timing of flow releases from Bull Run Dam 2. The goal was to protect and improve aquatic habitat in the lower six miles of the Bull Run River.

Two flow regimes are included in this HCP: normal water years and water years that have either a critical spring season or a critical fall season.¹ Instream minimum flows had not been previously established for the lower Bull Run River. To design the flow regimes, the City evaluated ongoing operations and identified opportunities for instream habitat enhancement below the water supply dams. The flow regime is structured according to four key components: guaranteed minimum flow, variable flow to manage temperature, a fall season flow increment based on percent of reservoir inflow, and a maximum required flow (cap) to manage reservoir refill. The fall season increment is determined by the minimum flow commitment or the percentage of reservoir inflows—whichever is higher. The maximum fall flow is defined by the cap until reservoir refill is complete. Critical spring seasons are predicted to occur 20 percent of the time; critical fall seasons are predicted to occur 10 percent of the time.

The guaranteed minimum flows for the HCP will be expressed as the mean daily flows in cubic feet per second (cfs). The flows will be recorded by the U. S. Geological Service (USGS) every 15 to 30 minutes and the City will determine the mean of the daily flows. The City will also determine the mean daily maximum water temperatures for the water temperature conservation measures.

Drawdown is defined as the point in time annually when water supply diversions consistently exceed reservoir inflows and precipitation is not anticipated. Refill is defined as the point in time annually when both reservoirs have filled to the normal winter operating ranges (1034-1036 feet above mean sea level (MSL) in Reservoir 1 and 858-860 feet above MSL in Reservoir 2).

In addition to the flow releases, the City created a measure to protect against large decreases in the river level due to reservoir operations that might otherwise trap small salmonids (i.e. downramping). The City will also sign a flow agreement that is expected to result in natural instream flows in the Little Sandy River for the term of the HCP. Chapter 8 discusses the habitat effects of the City's flow measures for each species.

Release of water into the lower Bull Run River for fish will have an effect on the water supply otherwise available from Bull Run for water system customers. The City anticipates

¹ The water year is the 12 months beginning on October 1 of one year and ending September 30 of the following year. For example, water year 2000 began on October 1, 1999 and ended September 30, 2000.

using groundwater from the Columbia South Shore Well Field to ensure an adequate supply, particularly in dry years. Water conservation programs also help ensure an adequate future supply by decreasing water demand. Chapter 2 provides additional background on the wellfield and on the City's water conservation programs.

Flow Releases During Normal Water Years

Minimum instream flows to improve fish habitat conditions in the lower Bull Run River during normal water years are described in Measure F-1. The measure includes guaranteed minimum flow amounts and other criteria that will maintain flow levels for spawning, rearing, and migrating salmonids and other aquatic species.

Measure F-1—Minimum Instream Flows, Normal Water Years: For HCP Years 1–50, the Bull Run water supply will be operated during normal water years to achieve the guaranteed flows in the lower Bull Run River specified in Table 7–2 (expressed in mean daily flows in cubic feet per second, cfs).

Table 7-2. Flow Commitments for the Lower Bull Run River During Normal Water Years, Measured at USGS Gauge 14140000, RM 4.7

Time Period	Guaranteed Minimum Flow (cfs)	Required Percent of Inflow	Maximum Required Flow (cfs)
January 1–June 15	120	n/a ^a	n/a
June 16–June 30	Gradually decrease flows over 15 days from minimum of 120 cfs to a minimum of 35 cfs. If reservoir drawdown begins before June 30, decrease flows at no more than 2"/hour to reach the 20–40 cfs operating range, see below.		
July 1–September 30	Vary flow from 20 cfs to 40 cfs to manage downstream water temperature ^b		
October 1–October 31	70	50%	400
November 1–November 30	150	40%	400
December 1–December 31	120	n/a	n/a

^an/a = not applicable

^bSee Measure T-1.

For the period from June 16 to June 30, the guaranteed minimum flow of 120 cfs will be decreased by 5 cfs per day until the minimum of 35 cfs is achieved at Gauge No. 14140000.

Variable flows will be implemented in summer (July through September) of normal water years. Water temperature is a key management concern during this season, and the reservoirs will be operated to take advantage of the limited amount of cold water that can be stored. Releases from the reservoirs will vary with weather conditions to better manage use of the available cold water. During mild weather, when temperatures in the river are naturally lower, less cold water will be released from the reservoirs. During warm weather, when cold water from the reservoirs is needed to moderate river temperatures, more cold water will be released. The resulting average summer flow in normal water years is expected to be 35 cfs.

Flow releases in October and November are defined as a percentage of reservoir inflow, with both upper and lower bounds as shown in Table 7–2. The City will provide a “floor” or minimum flow levels for the lower Bull Run River. The City will also cap the maximum flow level in October and November to allow the reservoir to refill to reduce the potential for unacceptable turbidity. The percentage of inflow released is higher in October than

Measure description continued on next page.

Measure F-1, continued

in November, but the total amount of water released will be higher in November because (1) the floor for the November minimum flow is higher than the floor for October and (2) inflow is generally higher in November than October.

Basing water release on a percentage of inflow will ensure that fall flow in the lower river is determined by flow into the reservoirs, not by the amount of water stored in the reservoirs or the amount diverted for municipal supply. Reservoir storage and diversions are both affected by water demand. Inflow is not affected by water demand.

The City will control streamflow releases below Dam 2 at Headworks (RM 6.0 on the Bull Run River) and the lower Bull Run River flow will be measured at USGS Gauge No. 14140000 (RM 4.7). For purposes of determining streamflow releases in October and November, reservoir inflow will be measured and totaled for four USGS Gauges (No. 14138850, Bull Run River at RM 14.8; No. 14138870, Fir Creek at RM 0.6; No. 14138900, North Fork Bull Run River at approximately RM 0.2; and No. 14139800, South Fork Bull Run River at RM 0.6). The daily mean flows of the four gauges will be added and then multiplied by 1.2 to account for the ungauged area of reservoir inflows in the Bull Run Watershed.

City staff will determine the week's reservoir inflows once a week and determine the following week's flow target based upon the inflow data. The first determination of reservoir inflow levels will occur prior to October 1. The flow releases to meet the targets will be implemented starting on October 1. Flow release targets will be set each week through the end of November.

Through the term of the HCP, the flow releases in the lower Bull Run River may exceed the guaranteed minimum flows in Table 7-2 if the reservoir inflows exceed demands for drinking water and the guaranteed minimum flows for fish.

The minimum flow requirements may not be met during the days that the Chinook surveys occur. Flows will be held to less than 150 cfs, as measured at USGS Gauge No. 14140000, to allow safe surveying. The surveys are expected to occur approximately once per week from August through November. See Appendix F for more details on the Chinook survey procedures.

Under Measures F-1 (normal water year) and F-2 (critical seasons), the flow in October and November is capped to allow for reservoir refill prior to fall storm events. Because the Bull Run water system is unfiltered, the water supply is vulnerable to high turbidity during fall storms. Turbidity interferes with effective disinfection of the water supply and increases the potential for waterborne disease. Intense late fall and winter storms can cut through sediment deltas and wash sediment from reservoir banks. These storms also flush accumulated sediment from tributaries into the reservoirs. Without filtration, turbidity generated by these storms can only be removed by dilution, settling, and flushing—none of which can be relied on to occur quickly. If heavy rain events occur when the reservoirs are low, the turbidity generated can move rapidly (within hours) from the tributaries to the intake towers. Full reservoirs help dilute the inflow and can slow the movement of turbid water long enough (about a day) to enable the City to shut down the reservoir supply and turn on the Columbia South Shore Well Field supply.

During recent events, in-reservoir turbidities higher than 20 NTUs (nephelometric turbidity units) have been recorded (late November, 1999). While this turbidity level does not adversely affect fish, it does exceed drinking water quality regulations. The filtration avoidance criterion for turbidity, as specified in the federal Surface Water Treatment Rule, is 5 NTU. If the City were to supply water exceeding 5 NTU, customers might have to boil their water and EPA could require construction of a filtration facility. Current practice is to not use the Bull Run supply when turbidity exceeds 3.5 NTU; groundwater from the Columbia South Shore Well Field is used instead.

The need to fill Bull Run reservoirs in the fall constrains the City's ability to provide fall season flows. The flow measures in the HCP do not guarantee the City's ability to refill the reservoirs, but they do reduce the risk that the reservoirs will not be refilled by November 15th to an acceptable level (less than 20 percent probability). If the reservoirs are already full and municipal demands are being met, flows in excess of the maximum (cap) can and will be released, primarily because there is no storage capacity in the watershed or in the distribution system to hold them.

Flow Releases During Years with Critical Water Seasons

Inflows will be lower and water demand will be higher in water years that have either a critical spring or fall season. The challenges involved in meeting water demand during dry years were used to design the critical season flow triggers. Three different water supply and demand situations are involved:

Years with a dry spring that causes early reservoir drawdown: In normal water years, drawdown typically begins in early July. Initiation of drawdown before June 15 is often an indication of a challenging summer season for water supply. If followed by a normal summer and fall, years of early drawdown are manageable and have a limited effect on the City's ability to provide flows for fish and for water temperature management. Unfortunately, there is no way to tell early in the season whether dry conditions will persist. If critical season flows are not implemented at the first sign of a potentially dry summer season (early drawdown), the effects of a continued dry season could be severe—both for water supply and for the City's ability to provide sustained flows and suitable water temperatures for fish.

Years with a normal spring and summer but a dry fall: Years that change from normal to dry late in the summer can be difficult to manage because the signal of trouble (insufficient inflow) comes late and the options to supplement water supply are, by then, more limited. Fall is a challenging season in all years because these months are when spawning and incubation for Chinook occurs, the reservoirs reach their lowest levels, and the threat of water shortage is greatest. Without early fall rain to increase inflow, releases can quickly outstrip remaining reservoir capacity. Lack of rain in the late fall can also delay refill of the reservoirs and exacerbate efforts to control turbidity during early winter storms. Sporadic fall rains can partially alleviate low reservoir levels, but they make it difficult to judge if and when reservoir refill will actually occur.

Years that are dry from spring through fall: This scenario has the most serious implications for water supply. For purposes of the HCP, these circumstances mean that the watershed faces both spring and fall critical conditions. The problem in such years is the very long duration of drawdown and the resulting large volume of water needed to satisfy the needs of both people and fish.

As described in Measure F-2, the HCP establishes “triggers” to determine the onset of either spring or fall critical flow conditions. The spring and fall season triggers are independent, but it is possible that both would be triggered in a single year. It is more likely that only one would be triggered. The combination of normal and critical flows in any single water year will be determined by the weather.

If critical spring conditions arise, the City will ramp down to summer flows earlier. Summer flows through September 30, however, remain as during normal flow years, varying from 20 to 40 cfs for purposes of meeting water temperature targets.

If critical fall conditions arise, the flow changes compared to normal years will be as follows:

- Summer minimum flows of 20–40 cfs will extend until October 15, rather than ending in late September.
- From October 16 to November 15, minimum guaranteed flows will be reduced to 30 cfs (from 70 cfs) and maximum flow released will be 250 cfs (from 400 cfs under normal years).
- From November 16 to November 30, the minimum guaranteed flows are reduced to 70 cfs (from 150 cfs) and maximum required flows are reduced to 350 cfs (from 400 cfs).

Measure F-2 describes the flows to be implemented in water years with critical seasons when reservoir inflows are very low.

Measure F-2—Minimum Instream Flows, Water Years With Critical Seasons: During HCP Years 1–50, for any years that have a critical spring or fall season, the Bull Run water supply will be operated to achieve the guaranteed flows in the lower Bull Run River specified in Tables 7–4 and 7–5 (in mean daily flow in cfs). Fall flows in Table 7–5 will not be implemented more frequently than two years in a row and will not be implemented 4 years after a previous season of critical fall flows has been implemented (to avoid affecting the same age cohort twice). If a year does not have a critical spring or fall season, all flows will be the normal water year flows described in Measure F–1.

The triggers for a critical spring or fall season are defined in Table 7–3.

Table 7-3. Critical Spring and Fall Season Triggers

Critical Season	Trigger
Spring	Drawdown occurs prior to June 15
Fall	August and September inflows within lowest 10% of historic record (1940 to current HCP Year)

The response to a critical spring season is outlined in Table 7–4.

Table 7-4. Flow Commitments for the Lower Bull Run River During Water Years with Critical Spring Seasons

Time Period	Guaranteed Minimum Flow ^a (cfs)	
June 1-June 30	30	If critical spring season trigger is met, decrease flow after drawdown begins but no earlier than June 1. Maintain downramping rate described in Measure F-3, from 120 cfs to 30 cfs.

^a Measured at USGS Gauge No. 14140000 (RM 4.7)

In any year of the HCP when a critical spring season has been triggered, there may be additional rain that temporarily raises reservoir inflow levels above outflow levels. The City may elect, in such circumstances, to raise the flow of the Bull Run River higher than the critical-period guaranteed minimums indicated in Table 7–2. Also, the City may elect to release more flow than the guaranteed minimum to the lower Bull Run River during critical spring seasons to meet water temperature objectives as described in Measure T–1 and T–2.

The trigger for the critical fall season is based on whether the mean daily flow for the August and September inflows to the Bull Run reservoirs are within the lowest 10 percent of historical flows for that time period. Throughout HCP Years 1–50, the 10th-percentile flow level will be updated annually to include new years of record.

Measure description continued on next page.

Measure F-2, continued

Table 7-5. Flow Commitments for the Lower Bull Run River During Water Years with Critical Fall Seasons^a

Time Period	Guaranteed Minimum Flow ^a (cfs)	Required Percent of Inflow (cfs)	Maximum Required Flow (cfs)
October 1–October 15	20	If critical fall season trigger is met, continue to vary flow from 20–40 cfs to manage downstream water temperature	
October 16–October 31	30	50%	250
November 1–November 15	30	40%	250
November 16–November 30	70	40%	350
December 1–May 31	120	n/a	n/a

^aMeasured at USGS Gauge No. 14140000 (RM 4.7)

The percentage of inflow and maximum flow requirements might not be met during the days that the Chinook surveys occur. Flows will be held to less than 150 cfs, as measured at USGS Gauge No. 14140000, to allow safe surveying. The surveys are expected to occur approximately once per week from August through November. See Appendix F for more details on the Chinook survey procedures.

The City will control streamflow releases at Headworks (RM 5.9 on the Bull Run River) and the lower Bull Run River flow will be measured at USGS Gauge No. 14140000 (RM 4.7). For purposes of determining streamflow releases in October and November, reservoir inflow will be measured and totaled for four USGS Gauges (No. 14138850, Bull Run River at RM 14.8; No. 14138870, Fir Creek at RM 0.6; No. 14138900, North Fork Bull Run River at approximately RM 0.2; and No. 14139800, South Fork Bull Run River at RM 0.6). The daily mean flows of the four gauges will be added and then multiplied by 1.2 to account for the ungauged area of reservoir inflows in the Bull Run Watershed. City staff will determine the previous week's reservoir inflows once each week and establish the next week's flow release target based on that inflow data. The first determination of streamflow level will occur prior to October 1. The flow releases to meet the targets will be implemented starting on October 1. Additional flow release targets will be set each week through the end of November.

Flow Downramping

Hydropower operation occurs as a byproduct of water supply operation. The existing Federal Energy Regulatory Commission (FERC) license for the City's Bull Run Hydroelectric Project specifies a maximum ramping rate (up or down) of two feet per hour as measured at USGS Gauge No. 14140000 (RM 4.7). Ramping up flows at this rate is not particularly problematic for covered fish species, but lowering the river at this rate can strand juvenile salmonids in side channels and isolated pools. The City is committing to a lower downramping rate to reduce effects on covered fish in the lower Bull Run and Sandy rivers.

Measure F-3—Flow Downramping: For HCP Years 1–50, the City will release flow into the lower Bull Run River, below Dam 2 as a result of hydropower operation, at a maximum downramping rate of no more than 2"/hour (0.17 feet/hour), as measured at USGS Gauge 14140000 (RM 4.7). City staff will monitor recordings at USGS Gauge No. 14140000 to ensure that the decreases adhere to this downramping rate.

This maximum downramping rate will not apply to events beyond the control of system operators, such as unexpected power grid interruptions, downed power lines, equipment failures, emergency responses at the Headworks as required to assure compliance with federal Safe Drinking Water standards, the mandatory annual testing of the powerhouse, and other circumstances that preclude the use of the North Tunnel or Diversion Pool at the City's water supply Headworks. The maximum downramping rate will also not apply when naturally occurring high flows, as measured at USGS Gauge 14138850 (Bull Run RM 14.8), decrease by more than two inches per hour.

7.2.2 Little Sandy River Flows

The City and Portland General Electric (PGE) are the only two entities with water rights claims on the Little Sandy River. The City has a statutory water right on the Little Sandy River, a tributary of the Bull Run River, with a priority date of 1909. Both the City of Portland and PGE have claims to water rights on the Little Sandy River with earlier priority dates. PGE's water claim (1907 priority date) will be converted to an instream right as part of the decommissioning of its Bull Run hydroelectric project (which includes Marmot Dam, Little Sandy Dam, Roslyn Lake, and the Bull Run powerhouse). The City's water claim (1892 priority date) and water right (1909) on the Little Sandy will continue to exist.

The City will forgo consumptive use of Little Sandy water under the 1892 claim and the 1909 right for the term of the HCP. When coupled with the conversion of PGE's claim to instream use, the City's action assures natural flows in the Little Sandy for 50 years. In addition, flows in the lower Bull Run River, below the confluence with the Little Sandy and above PGE's

Bull Run powerhouse (about 1.5 miles), will be significantly higher than flows that occurred during PGE's Marmot/Little Sandy hydropower operation (when most Little Sandy River flows were diverted to Roslyn Lake).

Measure F-4—Little Sandy Flow Agreement: In HCP Years 1–5, the City will create a flow agreement documenting the City's commitment to forgo exercise of the City's water right and claims to the Little Sandy River for the term of the HCP. Flows associated with the City's unexercised water rights will remain instream.

7.2.3 Water Temperature Measures for the Lower Bull Run River

Warm water temperature significantly affects salmon and steelhead production in the lower Bull Run River. The lower Bull Run has been identified as a water-quality-limited stream by the Oregon Department of Environmental Quality (ODEQ 2005). Chinook, steelhead, and coho are all affected by the water temperature conditions.

The City will alter its water supply infrastructure and its water supply operations to reduce water temperatures in the lower Bull Run River. The City's strategy relies on sharing the available cold water in the Bull Run reservoirs.

The City cannot dedicate all the cold water to the fish, diverting only warm water to the water supply system, without threatening drinking water quality. Excessively warm water in the distribution system could cause bacteriological growth and nitrification. These processes deteriorate the chlorine residual levels in drinking water; the chlorine levels are set by public health regulations to protect customers from pathogenic organisms. Attempts to manage or ameliorate nitrification problems once they occur can require extensive flushing of the reservoirs and the water mains, which wastes water and can result in combined sewer overflows. Excessively warm water in the open reservoirs at Mt. Tabor and Washington Park also promotes algae growth, which reduces chlorine residual and causes an unpleasant taste and smell. The City plans to maintain conduit water temperatures that will prevent such conditions from developing to avoid non-compliance with drinking water regulations.

The City's temperature management measures involve both infrastructure and operational changes. The infrastructure changes include modifying the Dam 2 water intake structures and the Dam 2 stilling pool and its rock weir. Both of these changes allow more effective use of cold water stored in the reservoirs. The operating changes involve the variable flow releases described in Section 7.2. Flow releases for July through September will vary within a prescribed range of 20 to 40 cfs in response to changing weather conditions. Once water temperatures naturally begin to decline in late October for physical reasons (e.g., shorter day length, lower sun angle), the minimum flows established in Measures F-1 and F-2 will be sufficient to limit high water temperatures. The City will store cold water in the reservoirs in early summer when overall temperatures are lower, and release it in the late summer when river temperatures are warmer. The multilevel intakes already existing at Dam 1 are used for this purpose.

Design, permitting, and construction of the infrastructure changes at Dam 2 will take several years. Until the changes are in place and operational (2013), the City will maintain the 7-day

moving average of the maximum daily water temperature of the lower Bull Run River below 21°C for salmon/trout rearing (described in Measure T-1). The City chose a 21 °C maximum target because it allows for continued salmonid growth (Sullivan et al., 2000) and because the City cannot meet a lower maximum temperature with the current water supply infrastructure. In 2005 and 2006 the City maintained a maximum water temperature target of 21 °C for the lower Bull Run River. For those years, the mean water temperature was approximately 16.5 °C.

Analysis leading to the development of the City's temperature measures is described in ODEQ's TMDL for the Sandy River (ODEQ, 2005). Appendix G of this HCP is the Temperature Management Plan (TMP), approved by ODEQ in May 2008 to comply with the TMDL. The TMP describes the steps the City will take to comply with Clean Water Act requirements for water temperature, and refers directly to the flow, temperature, and riparian measures included in this chapter of the HCP.

Measure T-1—Pre-infrastructure Temperature Management: Prior to the completion of the infrastructure changes described in Measure T-2, the City will manage flow releases from Headworks to maintain the 7-day moving average water temperature of the daily maximums at equal to or less than 21.0 °C. Stream temperatures will be recorded at Larson's Bridge on the mainstem Bull Run River (USGS Gauge No. 14140020).

Measure T-2—Post-infrastructure Temperature Management: Within HCP Years 1–5, the City will design, permit, and complete two significant changes to Bull Run water supply infrastructure to implement this conservation measure:

The Dam 2 intake towers will be modified to allow taking water from the reservoir at different levels.

The spillway rock weir in the Bull Run River immediately downstream of the Dam 2 spillway will be modified to allow rapid movement of flow through the spillway stilling basin.

After the infrastructure changes are made to the Dam 2 intake towers and the spillway rock weir, the City will manage flow to meet Oregon state water quality standards in the lower Bull Run River, as established in ODEQ's Sandy River Basin TMDL (ODEQ, 2005) and the ODEQ-approved Temperature Management Plan. The City will use the Little Sandy River water temperature (measured at USGS gauge 14141500) as a surrogate for the natural thermal potential of the lower Bull Run River. Water temperature compliance will be measured at Larson's Bridge on the mainstem Bull Run River (USGS site 14140020). All water temperatures will be expressed as the 7-day moving average of the daily maximum temperature.

Measure description continued on next page.

Measure T-2, continued

Per the Sandy River Basin TMDL, Bull Run River water temperature target will be maintained

- at or below the appropriate biologically based numeric temperature criteria shown in Table 7-6 when the Little Sandy River temperature is below the criteria

Table 7-6. Appropriate Numeric Temperature Criteria

River Reach	Time Period	Habitat Use	Numeric Criterion (7-Day Average Maximum)
River Mile 0 to 5.3	June 16 to August 14	Salmonid rearing	16°C
	August 15 to June 15	Salmonid spawning	13°C
River Mile 5.3 to 5.8	June 16 to October 14	Salmonid rearing	16°C
	October 15 to June 15	Salmonid spawning	13°C

Source: ODEQ 2005

or

- at or below the Little Sandy River temperature (as adjusted, see below) when the Little Sandy River temperature is above the numeric criteria

Also per the TMDL, the Bull Run water temperature target will be adjusted above the actual measured Little Sandy temperatures as follows:

- Between August 16 and October 15, allowances will be made for a 1.0 °C departure above the Little Sandy temperature.
- If the 7-day moving average of daily maximum air temperature is above 27 °C, the lower Bull Run water temperature target will be the lower Little Sandy River water temperature plus 1 °C.
- If the 7-day moving average of daily maximum air temperature is above 28 °C, the lower Bull Run water temperature target will be the lower Little Sandy River water temperature plus 1.5 °C.

The ODEQ temperature standards [OAR 340-041-0028(12)(c)] provide an additional exception if the maximum daily air temperature exceeds the 90th percentile of the 7-day average of the daily maximum air temperature calculated in a yearly series over the historical record. If this situation occurs in the lower Bull Run River, the numeric criteria and natural condition criteria (Little Sandy water temperatures as adjusted above) would not apply.

Daily maximum air temperatures will be recorded at the Water Bureau's Headworks facility below Dam 2 (approx. RM 6).

Measure description continued on next page.

Measure T-2, continued

The Bull Run water temperature criteria will also not apply to events beyond the control of the water system operators, such as unexpected power grid interruptions, downed power lines, equipment failures, loss of computer contact with the Dam 2 intake towers, emergency responses at Headworks as required to assure compliance with federal Safe Drinking Water standards, the mandatory annual testing of the protection devices at the powerhouse, and other circumstances that preclude the use of the intake towers or diversion pool at the City's water supply Headworks.

7.2.4 Habitat Measures in the Lower Bull Run River

Gravel Augmentation

The Bull Run reservoirs trap gravel and reduce gravel input to the lower river. Recent studies by R2 Resource Consultants (1998b) and Beak Consultants (2000a) have shown that Chinook salmon and steelhead populations in the lower Bull Run River are limited by the lack of gravel for spawning. The City will replenish spawning gravel and mimic natural supply and accumulation as described in Measure H-1. The three selected sites provide the best combinations of access for delivery of gravel to the river and proximity to known spawning areas (CH2M HILL, 2000). There are more specifics on gravel augmentation in Appendix F.

Measure H-1—Spawning Gravel Placement: The City will augment spawning gravel in the lower Bull Run River and monitor the effects of the gravel placements. A total of 1,200 cubic yards of gravel will be placed in the river annually during HCP Years 1–5; 600 cubic yards will be placed annually for the remainder of the HCP term (HCP Years 6–50). The gravel will consist of a spawning matrix composed of medium to very coarse material (0.5 to 4 inches) that has been washed or sorted to remove fine sediment. The City will purchase gravel from companies with current valid permits for the mining or removal of gravel. The City will only purchase gravel that comes from areas outside of river floodplains.

Measure description continued on next page.

Measure H-1, continued

Gravel will be placed in the river downstream of the City's water supply intakes. Equal amounts will be placed at three locations:

- 1,200 feet downstream of the Plunge Pool at RM 5.7
- 450 feet downstream of USGS Gauge No. 1414000 at RM 4.7
- 600 feet downstream of Larson's Bridge at RM 4.0

Spawning gravel placement will occur in December after the primary fall Chinook salmon spawning period, and before steelhead spawning starts in the spring.

Gravel placements will continue as described above unless

- the lower Bull Run River does not experience high enough flows to distribute the gravel at the three placement locations

or

- the gravel placement is determined to be ineffective for creating spawning habitat for the covered species.

If either of these two conditions arise, the City will work with the NMFS to modify implementation of the measure as needed.

Appendix F describes how the City will assess the effectiveness of the placed spawning gravel.

This habitat conservation measure includes provisions for adaptive management. If the five-year trial proves effective at improving spawning habitat for salmon and steelhead, the City will continue gravel placement for the 50-year term of the HCP. If gravel augmentation is found to be ineffective, the City will reallocate the associated budget (approximately \$15,000 per year) to other habitat conservation measures benefiting the covered species (see the Adaptive Management section of Chapter 9).

Fish Passage

Walker Creek is the only tributary to the lower Bull Run River in which a City culvert has blocked fish access. The short stream probably supported steelhead, coho, and cutthroat trout historically.

Measure P-1—Walker Creek Fish Passage: Within HCP Years 1-5, the City will provide volitional fish passage into Walker Creek. Passage design will be reviewed and approved in advance by NMFS.

Riparian Forest Protection

Riparian forest plays a key role in the health and productivity of freshwater habitats for fish. Examples of some of the habitat functions provided by a riparian forest are the following:

- Input of large wood through tree fall
- Moderation of water temperature through shading
- Input of nutrients from dropped leaves and debris
- Maintenance of bank stability
- Maintenance of water quality by trapping sediment

Past management practices have left many riparian forests impaired in their ability to provide these functions, with resulting degradation of instream habitats. City-owned lands along the lower Bull Run River, on the other hand, have experienced minimal timber harvest cutting the past 90 years and remain capable of providing riparian habitat at a level comparable to unmanaged late-seral forest. The City will continue managing these lands for the duration of the HCP so that their value to instream habitat will be maintained, and in some cases improved.

Note: None of the City-owned lands included in Measure H-2 are involved in the City-USFS land exchange described in Chapter 2. City-owned lands included here are expected to remain City-owned for the term of the HCP.

Measure H-2—Riparian Land Protection: For HCP Years 1-50, City-owned lands adjacent to the lower Bull Run River will be managed for the conservation of riparian habitat. The City will not cut trees within 200 feet of the river's average high water level on City-owned lands for the term of the HCP. A tree, as defined here, is any coniferous species with a minimum average diameter at breast height of 12 inches. Exceptions will include selective tree cutting to construct, maintain, and operate water supply and treatment facilities, water monitoring facilities, power lines, roads, and bridges. The City will also remove trees if they threaten City facilities, pose a significant risk to human safety, or when the City and NMFS determine selective cutting is desirable for the purpose of maintaining or improving riparian habitat. If trees are removed, the City will assess the site to determine whether an appropriate riparian species could be planted where the tree (or trees) was removed and will replant trees where feasible. The planted trees will be species that do not grow as tall as the removed trees. See also Measures W-1 and W-2.

7.3 Bull Run Reservoir Habitat Conservation Measures

The City will implement three measures to address potential impacts of covered activities in the Bull Run reservoirs. The HCP Objective (from Chapter 6) that guides these measures is the following:

- Avoid or minimize periodic temporary disturbance of habitat (for species both covered or addressed) that might otherwise result from routine operation, maintenance, and repair of water supply facilities

The City will avoid or minimize mortality of cutthroat and rainbow trout in the two Bull Run reservoirs by operating the reservoirs in a manner consistent with past operating criteria (see Measure R-1) for the term of the HCP. Removal of cutthroat trout and other fish species from the spillway canal will avoid mortality due to high water temperatures when pools in the canal become isolated from the reservoirs during the summer. Removal of reed canarygrass (*Phalaris arundinacea*), an invasive non-native species, will minimize impacts of reservoir operation on salamanders, toads, and frogs.

Reservoir Operations

The City has managed the Bull Run reservoirs to achieve water supply goals for many years. The City will continue to manage the reservoirs to assure compliance with federal Safe Drinking Water standards and according to the current operating criteria described in Measure R-1.

Measure R-1—Reservoir Operations: For HCP Year 1–50, the City will operate the two Bull Run reservoirs to avoid or minimize mortality of cutthroat and rainbow trout. The operating criteria for the reservoirs will be the following:

1. When the City is operating its hydroelectric powerhouses at the two Bull Run dams during the winter, the reservoir surface elevations will not normally vary outside of the upper two feet of the reservoirs' normal full pool range (except as noted in items 2 and 3 below). For Bull Run Reservoir No. 1, the elevation range is 1,034 to 1,036 feet above MSL. For Reservoir 2, the range is 858 to 860 feet above MSL.
2. The City will lower the surface elevation of the two reservoirs beyond the upper two feet of the normal full pool level only for water supply and/or quality reasons, for downstream fish habitat reasons, for dam safety reasons, or for repairs or maintenance to the dam or hydropower project facilities.
3. The City will operate the two reservoirs as needed to maintain required streamflows and water temperatures in the lower Bull Run River for covered species.
4. During the summer drawdown season, Reservoir 1 may be lowered to approximately elevation 970 feet above MSL and Reservoir 2 may be lowered to approximately 832 feet above MSL as needed for water supply purposes
5. At the end of each drawdown season, the two Bull Run reservoirs will be filled as rainfall, streamflow and required downstream releases permit.
6. The spillway gates on Bull Run Dam No. 1 will be lowered onto the spillway crest in the spring to store additional water for use in the summer months. After the risk of major flooding has passed, and any habitat maintenance work has been completed in the upper reaches of Bull Run Reservoir No. 1 (see Measure R-3, Reed Canarygrass Removal), the water surface level in that reservoir will be raised to a summer supply full pool level of 1045 feet.
7. The City will use 4-cycle engines on its boats to minimize reservoir water pollution.

The two Bull Run Reservoirs are currently operated under a FERC license agreement that is valid until 2029, and a Special Use Permit from the USFS. If, during the term of the HCP, these license agreements are changed or if the operating criteria for the reservoirs need to be modified, the City will work with NMFS to assess effects on the covered species.

Spillway Approach Canal

When the Reservoir 2 water surface elevation is 855—860 feet above MSL, the spillway approach canal is connected to the reservoir and is full of water. Cutthroat trout swim into the approach canal and can get trapped once the reservoir drops below elevation 855 after drawdown and the canal becomes isolated. Water in the canal during the summer varies in depth with a maximum depth of approximately 15 feet. The water temperature in the canal ranges from 21 °C to 27 °C in July, and can be lethal for cutthroat trout (Bell 1990).

In 2000, the City drained the spillway approach canal and attempted to rescue the cutthroat trout. The City trapped 108 cutthroat trout during that effort and successfully placed 47 fish, 3–14" long, back in Reservoir 2. Because of the high water temperatures, 61 fish died during the operation.

Measure R-2—Cutthroat Trout Rescue: For HCP Years 1–50, the City will remove cutthroat trout from the Dam 2 spillway approach canal annually to prevent mortality due to elevated summer water temperatures.

The City will use several approaches to implement this measure and will determine which one is most effective.

In HCP Year 1, the City will install a fyke net and place salmon eggs in a basket in the trap box to attract cutthroat trout. The fyke net will be placed in the spillway approach canal in early June when water temperatures are cool and will be checked two to three times per week through the end of the month. After June, and when drawdown first starts to isolate the water in the spillway approach canal, the City will drain the canal to determine whether the fyke net was effective for capturing fish.

If at least two-thirds of the cutthroat found in the approach canal are trapped by the fyke net and successfully returned to Reservoir 2, the City will continue that approach for HCP Years 2–50. If less than two-thirds of the cutthroat trout are successfully returned to Reservoir 2, the City will consider a new orientation and location for the fyke net.

After HCP Year 2, if the City determines that fyke netting does not effectively capture the cutthroat in the canal, the City will drain the canal in Reservoir 2 as soon as reservoir elevations allow.

If the City determines that draining the canal sends warm water down the Bull Run River, and interferes with the objectives for Measures T-1 and T-2, the City will not continue this conservation measure. Funding would be allocated to other habitat conservation measures according to the adaptive management process described in Chapter 9.

If the City's methods for the spillway approach canal fish rescue are ineffective—defined as having more than one-third mortality associated with the trapping of fish or leaving fish in the spillway to experience high water temperatures—the City will not continue the measure. In that case, the funding will be allocated to other habitat conservation measures according to the adaptive management process described in Chapter 9.

Reed Canarygrass

Western toads and red-legged frogs lay their eggs around the edges of the reservoirs in the Bull Run watershed. All pond-breeding amphibians need warm sunny shallows while their eggs and young are developing. The western toad and red-legged frog tadpoles use the north shoreline in upper Reservoir 1. The egg incubation for these species can be affected when reed canarygrass invades and shades their breeding areas. The City has identified three areas along the upper end of Bull Run Reservoir 1 that would have less than three feet of water when the reservoir is full, and these areas are important for reproduction and egg incubation for the toads and frogs.

Measure R-3—Reed Canarygrass Removal: For HCP Years 1-50, the City will cut and rake reed canarygrass away from three areas along the north bank of the upper end of Bull Run Reservoir 1. The City will access the site by boat from the reservoir and by trail. Power tools will be used for cutting the grass. Neither heavy equipment nor additional road access will be needed. The cutting will occur just prior to the summer season lowering of the spillway gates on Dam 1, which will flood the shallow area of the reservoir. The areas to be cut are approximately 10' x 15', 100' x 100', and 100' x 40'; this total area to be cut is approximately one-third acre.

7.4 Water System Operation and Maintenance Conservation Measures

The City maintains and operates the water supply facilities in the Bull Run watershed. Associated activities are introduced in Chapter 3 and described in more detail in Chapter 8, Section 8.7. The City will implement two measures to address potential impacts of these covered activities: Bull Run Infrastructure Operations and Maintenance, and Bull Run Spill Prevention.

Measure O&M-1— Bull Run Infrastructure Operations and Maintenance: For HCP Years 1–50, the City will take the following actions to avoid or minimize effects on species covered or addressed in the HCP in the Bull Run watershed:

Covered Lands

- The City will prevent paint and debris from falling in the river during bridge and conduit maintenance at all active stream crossings.
- The City will avoid or minimize erosion during repair and maintenance of all water supply infrastructure.
- Water drained from the conduits will be dechlorinated and routed through energy dissipaters prior to releases in the nearest waterway.
- The City will not use insecticides on covered lands. The City will allow BPA to use the herbicide Garlon 3A in a limited manner on the BPA transmission line easement on City land (see Section 8.7 for more information). The City will avoid or minimize use of other herbicides on covered lands except as necessary to control invasive plants. Plans for herbicide use that might affect habitat for covered species will be provided to NMFS for preapproval.
- The City will use fertilizers on lands if necessary to encourage plant establishment and growth after projects that cause ground disturbance (e.g., as part of hydroseeding).
- The City will remove trees in riparian areas if they threaten City facilities or pose a significant risk to human safety. The City will plant replacement trees, in the same approximate locations, if trees of greater than 12 inches diameter at breast height are cut.

Sandy River Station

- Within HCP Years 1–10, the City will evaluate stormwater drainage at Sandy River Station and improve facilities if needed.

See also Measures W-1 and W-2.

Measure O&M-2 — Bull Run Spill Prevention: For HCP Years 1–50, the City will implement the following actions to avoid or minimize spill effects on the species covered or addressed in the HCP in the Bull Run and Sandy rivers:

Headworks

- Fuel and chlorine deliveries will be escorted by a pilot car via paved roads.
- Secondary containment will be provided for the fuel tanks.
- Containment basins will be inspected and pumped out as needed.

Sandy River Station

- Secondary containment systems will be provided for the fuel tanks and pumps to contain any leaks. Containment basins will be inspected and pumped out as needed.
- Within Years 1–5 of the HCP, the City will evaluate the feasibility of moving existing fuel tanks and pumps out of the Sandy River floodplain. This feasibility analysis will be done in conjunction with a City capital improvement project.

See also Measures W-1 and W-2.

Table 7-6 summarizes the 14 measures the City will implement in the Bull Run as part of this HCP.

Table 7-7. Summary of Bull Run HCP Measures

#	Name	a) Habitat Attributes Affected ^a b) Historical Impacts in Bull Run Addressed c) Species Targeted for Primary Benefit ^a	Reaches Affected	Time Frame for Implementation
Flow Measures				
F-1	Minimum Instream Flows, Normal Water Years	a) Instream flow	Lower Bull Run River	Years 1–50 ^a
F-2	Minimum Instream Flows, Water Years with Critical Seasons	b) Reduced flow due to water diversions and both reservoir and hydropower operations	Lower Sandy River	
F-3	Flow Downramping	c) Fall Chinook, spring Chinook, winter steelhead, coho, cutthroat trout, lamprey		
F-4	Little Sandy Flow Agreement			
Temperature Measures				
T-1	Pre-infrastructure Temperature Management	a) Water quality	Lower Bull Run River	Until tower modifications are complete (2012)
		b) Warm water temperatures exacerbated due to reservoir operations		
T-2	Post-infrastructure Temperature Management	c) Fall Chinook, spring Chinook, winter steelhead, coho, cutthroat trout, lamprey		After tower modifications are complete
Fish Passage Measure				
P-1	Walker Creek Fish Passage	a) Fish access	Lower Bull Run River	Years 1–5
		b) Access currently blocked by a City culvert		
		c) Winter steelhead		

Table continued on next page.

Table 7-7. Summary of Bull Run HCP Measures, continued

#	Name	a) Habitat Attributes Affected ^a b) Historical Impacts in Bull Run Addressed c) Species Targeted for Primary Benefit ^a	Reaches Affected	Time Frame for Implementation
Reservoir Measures				
R-1	Reservoir Operations	a) Spawning area access and rearing habitat conditions b) Access to spawning areas, rearing conditions in the reservoirs, and fish entrainment c) Cutthroat trout, rainbow trout	Bull Run Reservoirs 1 and 2	Years 1–50
R-2	Cutthroat Trout Removal	a) Fish stranding b) Seasonal stranding in warm water pools located in Dam 2 spillway approach canal c) Cutthroat trout	Bull Run Reservoir 2	Years 1–50
R-3	Reed Canarygrass Control	a) Habitat diversity b) Seasonal disturbance of breeding habitat on a bench at the upper end of Reservoir 1 c) Western toad and red-legged frog	Bull Run Reservoir 1	Years 1–50
Water System Operation and Maintenance Conservation Measures				
O&M-1	Bull Run Infrastructure Operations and Maintenance	a) Habitat diversity, reservoir and river water quality, riparian function b) Minimal historical impact c) Fall Chinook, spring Chinook, steelhead, coho, cutthroat trout, rainbow trout, lamprey	Bull Run Reservoirs 1 and 2, Lower Bull Run River	Years 1–50
O&M-2	Bull Run Spill Prevention	a) Habitat diversity, reservoir and river water quality b) Minimal historical impact c) Fall Chinook, spring Chinook, steelhead, coho, cutthroat trout, rainbow trout, lamprey	Bull Run Reservoirs 1 and 2, Lower Bull Run River	Years 1–50

Table continued on next page.

Table 7-7. Summary of Bull Run HCP Measures, continued

#	Name	a) Habitat Attributes Affected ^a	Reaches Affected	Time Frame for Implementation
		b) Historical Impacts in Bull Run Addressed		
c) Species Targeted for Primary Benefit ^a				
Habitat Measures				
H-1	Spawning Gravel Placement	a) Spawning gravel	Lower Bull Run River	Years 1–50
		b) Trapping of gravel behind Bull Run dams		
		c) Fall Chinook, spring Chinook, steelhead, coho, cutthroat trout		
H-2	Riparian Land Protection	a) Habitat diversity	Lower Bull Run River	Years 1–50
		b) Minimal historical impact. Riparian habitat along lower Bull Run River is in good condition.		
		c) Fall Chinook, spring Chinook, steelhead, coho, cutthroat trout, lamprey		

^aSee Chapter 8 for additional information on affected reaches and species benefits.

7.5 Offsite Aquatic and Riparian Habitat Conservation Measures

Chapter 2 describes the City's rationale for implementing additional aquatic and riparian habitat conservation measures in the larger Sandy River Basin. Chapter 6 describes the City's HCP Goals and HCP Objectives. The HCP Objectives that guide the offsite Sandy River Basin measures are the following:

- Protect and improve instream and riparian habitat conditions for the primary covered fish species at targeted locations in the larger Sandy River Basin , particularly locations affected by covered activities or locations where benefits would offset impacts that are expected to continue to occur in the Bull Run River
- Provide habitat improvements offsite to specifically benefit spring Chinook spawning because of the constraints limiting spawning in the lower Bull Run River
- Provide habitat benefits offsite to specifically benefit fall Chinook, a species for which the Sandy River Basin population is particularly important to the Lower Columbia Evolutionarily Significant Unit (ESU)
- Avoid or minimize periodic temporary disturbance of habitat (for species both covered or addressed in the HCP) that might otherwise result from implementation of habitat conservation measures
- Choose locations and project types for offsite conservation measures based on the best available current information about habitat conditions, role in productivity of the four primary covered fish species, and the habitat factors limiting productivity
- Focus on private lands where incentives and requirements for habitat protection by the landowner are otherwise limited
- Prioritize projects that provide the most benefit per dollar paid by the City's ratepayers
- Assist the Sandy River Basin Partners with implementation of the Sandy River Basin Restoration Strategy

The City relied on the work of the Partners to identify appropriate aquatic and riparian habitat conservation opportunities in the Sandy River Basin. The Partners agreed in June 2000 to use the Ecosystem Diagnosis and Treatment (EDT) approach as a tool for documenting habitat conditions and quantifying potential fish production benefits from sets of conservation actions.

Fish biologists and other technical staff serving on a technical team were assigned specific streams/reaches within the Sandy River Basin. The technical team members used the EDT model to assess the habitat factors that limit the productivity of fish populations. The results are described as limiting factors in Chapter 5 (see Tables 5-8, 5-10, 5-17, 5-19, 5-26, 5-28, 5-36 and 5-38). The limiting factors analysis results were used to identify habitat factors that could be strategically implemented to improve habitat conditions and fish population productivity.

The result of the technical team effort was a database of more than 100 potential actions throughout the Sandy River Basin, not including options for the lower Bull Run River. These actions included riparian easements, placement of large wood and boulders, culvert removal, channel restoration, and land acquisitions. The City relied on this database to identify conservation actions for the HCP.

The Partners discussed the habitat conservation measures in a series of meetings in 2003 and 2004. In October 2004, the Partners signed an Agreement in Principle (AIP). The AIP acknowledged the collaborative work of the Partners from 1999 to 2004 and recommended that the City proceed to prepare an HCP based on the discussions up to that point (SRBP 2004).

The offsite measures described in this section are organized by watershed. For an overview of the Sandy River Basin, refer to Figure 4-1. For spatial relationships among tributaries in each watershed, refer to the maps in Chapter 4, organized by watershed.

Tables 7-7 through 7-13 in each watershed subsection provide summary information about the measures for that watershed, including the

- name and number of the measure
- habitat attributes affected
- historical impacts in the Bull Run watershed that are addressed through that measure
- species targeted for primary benefit from the measure
- reaches affected in each watershed
- time frame for implementing the measure

7.5.1 Habitat Conservation Measures in the Little Sandy River

The lowest reach of the Little Sandy River does not currently provide significant habitat for salmonids due to PGE's hydroelectric power project on the river. The hydroelectric project is scheduled to be decommissioned in 2008. Once the hydroelectric project is decommissioned, PGE's water right on the Little Sandy River will be converted to an instream right, which will increase flows in the Little Sandy River (see Measure F-4). The City will forgo its water right for consumptive use of the water for the term of the HCP. With the increased flows and upstream fish passage, the Little Sandy River could support anadromous fish production.

Large Wood Placements

Current large wood (LW) levels are low in the lower 1.8 miles of the Little Sandy River. LW additions will increase habitat complexity mainly for steelhead which would favor the Little Sandy because of its stream geomorphology and gradient.

Measure H-3—Little Sandy 1 and 2 LW Placement: During HCP Years 6–10, the City will work with willing landowners to place a minimum of 50 key pieces of large wood (LW) in the lower 1.8 miles of the Little Sandy River. The key pieces will be placed to collect other additional woody debris. Individual LW pieces will be sound conifer logs with a small-end diameter of at least 12 inches and a length of at least 30 feet. LW with large root wads, if available, will be given preference for placement. Artificial anchoring of the wood will only be used when wood movement cannot be tolerated. Anchoring will only be used if the large wood might move downstream and damage road culverts, bridges, private property or other streamside improvements. It is desirable for the stream to redistribute the placed large wood to some extent, as long as damage is avoided. Methods and timing for LW placement and maintenance will be determined in consultation with NMFS and the Oregon Department of Fish and Wildlife (ODFW).

The LW placement in the Little Sandy River will be maintained for 15 years. Year 1 of the maintenance will be the calendar year following the wood placement.

Table 7-7 is a summary of the Little Sandy offsite measure. Figure 7-2 is a map showing the location of Measure H-3.

Table 7-8. Offsite Habitat Conservation Measure in the Little Sandy River

#	Name	a) Habitat Attributes Affected ^a b) Historical Impacts in Bull Run Addressed c) Species Targeted for Primary Benefit ^b	Reaches Affected	Time Frame for Implementation
H-3	Little Sandy 1 and 2 LW Placement	a) Large wood b) Reduced habitat complexity c) Winter steelhead, coho	Little Sandy 1	Years 6–10

^aAlthough the HCP measures can affect multiple habitat attributes and have effects in multiple reaches, not every habitat attribute will be affected in each reach. For a reach-by-reach summary of the habitat attribute effects, see the tables in Chapter 8 or Appendix E.

^bSee Chapter 8 for additional species benefits

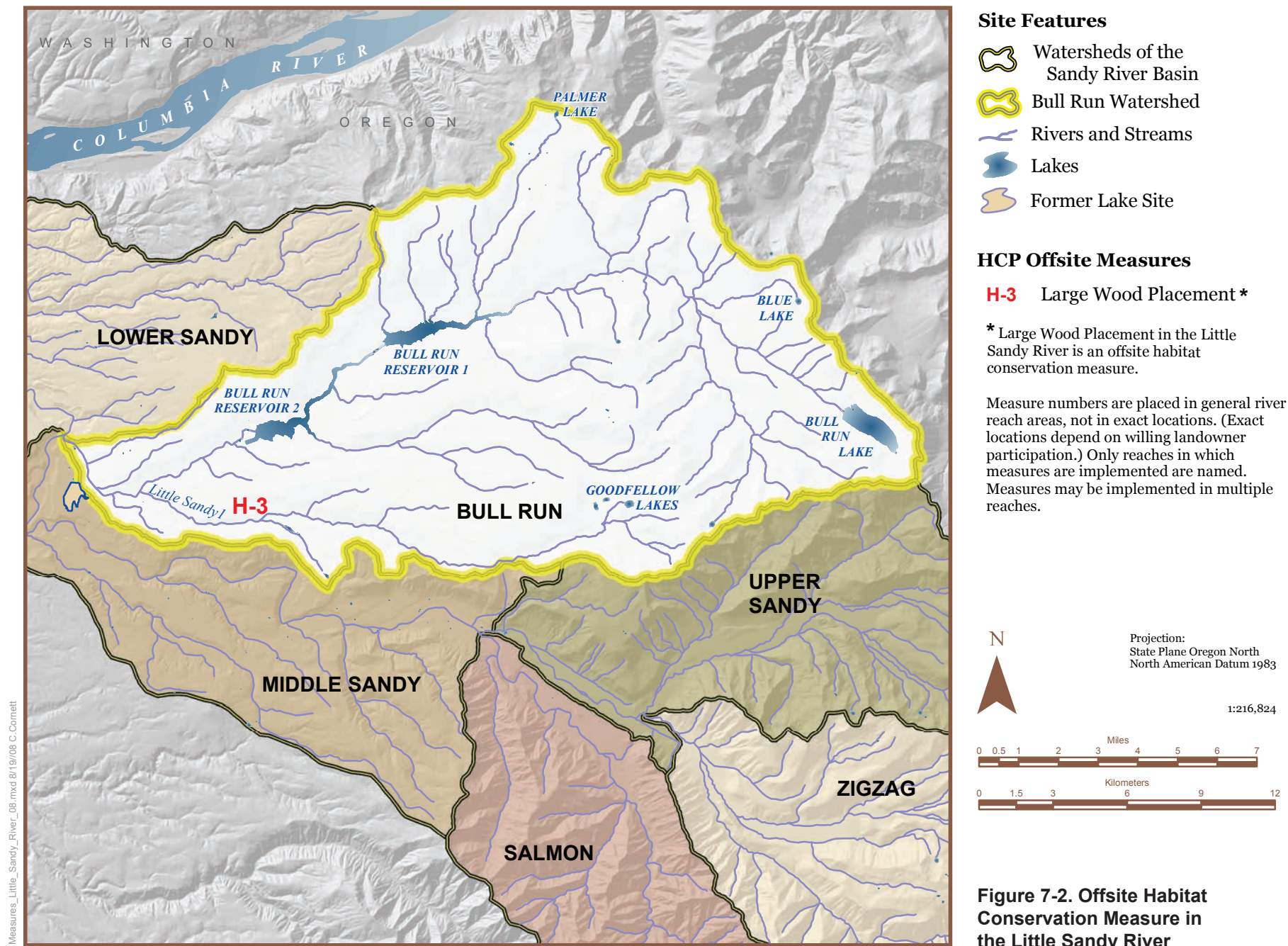


Figure 7-2. Offsite Habitat Conservation Measure in the Little Sandy River

7.5.2 Habitat Conservation Measures in the Lower Sandy River Watershed

The lower Sandy River watershed is an important migration corridor for all anadromous species in the Sandy River Basin and a core production area in the lower Columbia ESU for fall Chinook salmon (SRBWG 2005a). The majority of fall Chinook spawning occurs in the mainstem Sandy River and tributaries below Oxbow Park. Fall Chinook also use Gordon and Trout creeks for spawning when rains increase the flows in these tributaries (ODFW 1997).

Many of the lower Sandy reaches, however, lack naturally occurring habitat factors such as LW and natural stream meanders due to human activity either within the lower Sandy watershed or further upstream. The City's HCP measures in the lower Sandy watershed were selected to target improvements primarily for fall Chinook habitat. However, the habitat conservation measures will also improve important habitat for juveniles and adults of all species.

Large Wood

Lower Sandy River reaches 1 and 2 contain densities of large wood at roughly a quarter of estimated historic levels (City of Portland EDT database, 2005). Both reaches lack the large log jams characteristic of similar-sized alluvial channels in a pristine state. The log jam and LW measures for reaches in the lower Sandy will quickly provide benefits such as pools, cover, and nutrients for migrating fish.

Measure H-4—Sandy 1 and 2 Log Jams: Within HCP Years 6–10, the City will work with willing landowners to place engineered log jams at strategic locations along the shoreline within reaches Sandy 1 and Sandy 2. For this HCP, engineered log jams are defined as permanent collections of large wood that create or redirect flow and capture additional wood. The probable locations will be north of the Interstate 84 bridge (Sandy 1) and near Oxbow Park (Sandy 2). A minimum of 300 logs will be placed in the Sandy River reaches. The log jams will be designed to remain at the placed locations. The engineered log jams will be maintained for 15 years. Year 1 of the maintenance will be the calendar year following the wood placement.

The engineered log jams will increase the amount of large wood in reaches Sandy 1 and 2 both through the placement of logs and the subsequent accumulation and retention of wood naturally floating down the channel. They will also improve the functioning of the riparian zone by restoring flow to at least 2,100 lineal feet of side channel in reaches Sandy 1 and Sandy 2. The engineered jams will be designed to deflect flow into the side channels during at least average bankfull flows, which by definition will be at least every two years.

The City will monitor the engineered logs jams for 15 years after placement. If the river changes course during the 15 years after log jam construction, and any log jam is stranded out of the wetted channel, the City will cease monitoring activities on that log jam. Monitoring will restart if the wetted channel changes again to include the area where the log jam was originally placed.

Measure H-5—Gordon 1A and 1B LW Placement: Within HCP Years 1–5, the City will work with willing landowners to place a minimum of 300 key logs along the entire length of reaches Gordon 1A and 1B, at approximately 75 pieces per mile. Individual LW pieces will be sound conifer logs with a small-end diameter of at least 12 inches and a length of at least 30 feet. The key pieces will be placed to collect other additional woody debris. If available, large root wads will also be selected for placement. Artificial anchoring of the wood will only be used when wood movement cannot be tolerated. Anchoring will only be used if the large wood might move downstream and damage road culverts, bridges, private property or other streamside improvements. It is desirable for the stream to redistribute the placed large wood to some extent, as long as damage is avoided. Methods and timing for LW placement will be determined in consultation with NMFS and the ODFW.

The LW placement in Gordon Creek will be maintained for 15 years. Year 1 of the maintenance will be the calendar year following the wood placement. The City will monitor the wood as described in Chapter 9, Monitoring and Adaptive Management.

Measure H-6—Trout 1A LW Placement: Within HCP Years 1–5, the City will work with willing landowners to place logs in the upper one-third of reach Trout 1A, which is approximately 1,000 feet long. Individual LW pieces will be sound conifer logs with a small-end diameter of at least 12 inches and a length of at least 30 feet. The key pieces will be placed to collect other additional woody debris. If available, large root wads will also be selected for placement. Artificial anchoring of the wood will only be used when wood movement cannot be tolerated. Anchoring will only be used if the large wood might move downstream and damage road culverts, bridges, private property or other streamside improvements. It is desirable for the stream to redistribute the placed large wood to some extent, as long as damage is avoided. Methods and timing for LW placement will be determined in consultation with NMFS and the ODFW. A minimum of 25 key logs will be placed.

The LW placement in Trout 1A will be maintained for 15 years. Year 1 of the maintenance will be the calendar year following the wood placement.

Measure H-7—Trout 2A LW Placement: Within HCP Years 1–5, the City will work with willing landowners to place logs in the entire length of reach Trout 2A, which is approximately 1,500 feet long. Individual LW pieces will be sound conifer logs with a small-end diameter of at least 12 inches and a length of at least 30 feet. The key pieces will be placed to collect other additional woody debris. If available, large root wads will also be selected for placement. Artificial anchoring of the wood will only be used when wood movement cannot be tolerated. Anchoring will only be used if the large wood might move downstream and damage road culverts, bridges, private property or other streamside improvements. It is desirable for the stream to redistribute the placed large wood to some extent, as long as damage is avoided. Methods and timing for LW placement will be determined in consultation with NMFS and ODFW. A minimum of 20 key logs will be placed.

The LW placement in Trout 1A will be maintained for 15 years. Year 1 of the maintenance will be the calendar year following the wood placement.

Reconnection of Isolated Habitat

The re-establishment of the mouth of the Sandy River and the channel reconstruction will open the original mouth of the Sandy River to migrating fish and improve side-channel habitat. Approximately one mile of channel habitat will be opened and one-third of a mile of side-channel habitat will be maintained. Log placement in the Sandy 1 side channel will improve habitat diversity, providing cover and refuge for migrating fish. Measures H-8 and H-9 will be designed to minimize short-term effects to chum salmon and eulachon that may use the lower Sandy River stream reaches.

Measure H-8—Sandy 1 Reestablishment of River Mouth: Within HCP Years 6–10, the City will contribute up to a maximum of \$1.1 million for the removal of a 1930s-era dike in the Sandy River delta area in coordination with the Columbia River Gorge National Scenic Area. All project designs will be submitted to USFS and NMFS for review.

Measure H-9—Sandy 1 Channel Reconstruction: Within HCP Years 6–10, the City will construct a gradient control weir to maintain flow in a side-channel of the lower Sandy River. The work will occur downstream of the I-84 bridge in the lower reach. A minimum of 25 logs will also be placed in the side channel. All project designs will be submitted to USFS and NMFS for review.

The turtle species have very limited distributions within the Sandy River Basin. These species may be present in the lower delta, downstream of the I-84 bridge, where low-elevation pools and backwater areas are present. Disturbance of these turtles could occur as part of implementing measures H-8 and H-9, or other Habitat Fund projects in the Sandy River delta. Measure H-10 will minimize this disturbance.

Measure H-10—Turtle Survey and Relocation: The City will survey areas downstream of the I-84 bridge in the Sandy River delta for the presence of western painted and northwestern pond turtles if there will be any ground disturbance associated with implementation of the City's habitat conservation measures in the Sandy River delta (e.g., H-8 and H-9). Any of the two species of turtles that would be directly affected will be relocated. Relocations will be coordinated with ODFW.

Riparian Easements and Improvements

The City has identified three habitat conservation measures for the lower Sandy River watershed that will improve riparian zone conditions. The City will obtain easements from willing landowners for a total of approximately 150 acres of riparian lands in the lower Sandy River watershed. The land easements will improve and protect 100 feet of riparian forest on either side of the active channel width of the river or creeks. None of the areas has riparian zones that are in historical condition and the conservation measures include silvicultural practices (i.e., selective thinning and tree planting) to improve the riparian zones. The acreage totals for the land protection easements will be calculated by multiplying the lineal distance of the stream by the amount of riparian forest protected by the easement. These riparian easement and improvement measures have been identified for specific stream reaches in the lower Sandy.

Measure H-11—Sandy 1 Riparian Easement and Improvement: Within HCP Years 1–5, the City will acquire 100-foot-wide land protection easements from willing private landowners for at least 11 acres which will comprise the total number of lineal feet x 100 feet of riparian width on either side of the Sandy River in reach Sandy 1. At a minimum, the easements will be maintained for the term of the HCP. The City will also consider, on a voluntary and case-by-case basis, obtaining easements with durations longer than the term of the HCP and greater than 100 feet wide. The HCP funding for purchasing and maintaining each easement will be limited to what is defined in Chapter 11 of the HCP for that measure. The easement areas will be managed to support forest of ≥ 70 percent conifer trees (by canopy cover) where site conditions are conducive to the growth of conifers. Deciduous trees will be selectively thinned and the easement will be replanted with conifers. If the easement area is not conducive to the growth of conifers, the area will be managed to support the growth of native hardwood species. Management of the easements will also include control of invasive plant species. See also Measures W-1 and W-2.

Measure H-12—Sandy 2 Riparian Easement and Improvement: Within HCP Years 1–5, the City will acquire 100-foot-wide land protection easements from willing private landowners for at least 62 acres which will comprise the total number of lineal feet x 100 feet of riparian area on either side of the Sandy River in reach Sandy 2. At a minimum, the easements will be maintained for the term of the HCP. The City will also consider, on a voluntary and case-by-case basis, obtaining easements with durations longer than the term of the HCP and greater than 100 feet wide. The HCP funding for purchasing and maintaining each easement will be limited to what is defined in Chapter 11 of the HCP for that measure. The easement areas will be managed to support forest of ≥ 70 percent conifer trees (by canopy cover) where site conditions are conducive to the growth of conifers. Deciduous trees will be selectively thinned and replanted with conifers. If the easement area is not conducive to the growth of conifers, the area will be managed to support the growth of native hardwood species. Management of the easements will also include control of invasive plant species. See also Measures W-1 and W-2.

Measure H-13—Gordon 1A and 1B Riparian Easement and Improvement: Within HCP Years 1–5, the City will acquire 100-foot-wide land protection easements from willing private landowners for at least 78 acres which will comprise the total number of lineal feet x 100 feet of riparian area on either side of the Sandy River in reach Sandy 2. At a minimum, the easements will be maintained for the term of the HCP. The City will also consider, on a voluntary and case-by-case basis, obtaining easements with durations longer than the term of the HCP and greater than 100 feet wide. The HCP funding for purchasing and maintaining each easement will be limited to what is defined in Chapter 11 of the HCP for that measure. The easement areas will be managed to support forest of ≥ 70 percent conifer trees (by canopy cover) where site conditions are conducive to the growth of conifers. Deciduous trees will be selectively thinned and replanted with conifers. If the easement area is not conducive to the growth of conifers, the area will be managed to support the growth of native hardwood species. Management of the easements will also include control of invasive plant species. See also Measures W-1 and W-2.

Table 7-8 is a summary of the 10 habitat conservation measures in the lower Sandy River watershed. Figure 7-3 is a map showing the location of Measures H-4 through H-13.

Table 7-9. Offsite Habitat Conservation Measures in the Lower Sandy River Watershed

#	Name	a) Habitat Attributes Affected ^a b) Historical Impacts in Lower Sandy Addressed	Reaches Affected ^a	Time Frame for Implementation
		c) Species Targeted for Primary Benefit ^b		
H-4	Sandy 1 and 2 Log Jam Placements	a) Riparian function, large wood b) Reduced instream habitat complexity c) Fall Chinook	Sandy 1 Sandy 2	Years 6-10
H-5	Gordon LW Placement	a) Large wood b) Reduced instream channel complexity c) Fall Chinook, winter steelhead	Gordon 1A Gordon 1B Sandy 2	Years 1-5
H-6	Trout 1A LW Placement	a) Large wood b) Reduced instream channel complexity c) Fall Chinook, Winter Steelhead	Sandy 1 Sandy 2 Trout 1A	Years 1-5
H-7	Trout 2A LW Placement	a) Large wood b) Reduced instream channel complexity c) Fall Chinook, Winter Steelhead	Sandy 2 Trout 2A	Years 1-5
H-8	Sandy 1 Reestablishment of River Mouth	a) Riparian function, artificial confinement b) Multiple c) Fall Chinook	Sandy 1	Years 6-10
H-9	Sandy 1 Channel Reconstruction	a) Artificial confinement, large wood, riparian function b) Multiple c) Fall Chinook	Sandy 1	Years 6-10
H-10	Sandy 1 Turtle Survey and Relocation	a) Not applicable b) Not applicable c) Western painted turtle, northwestern pond turtle	Sandy 1	As needed

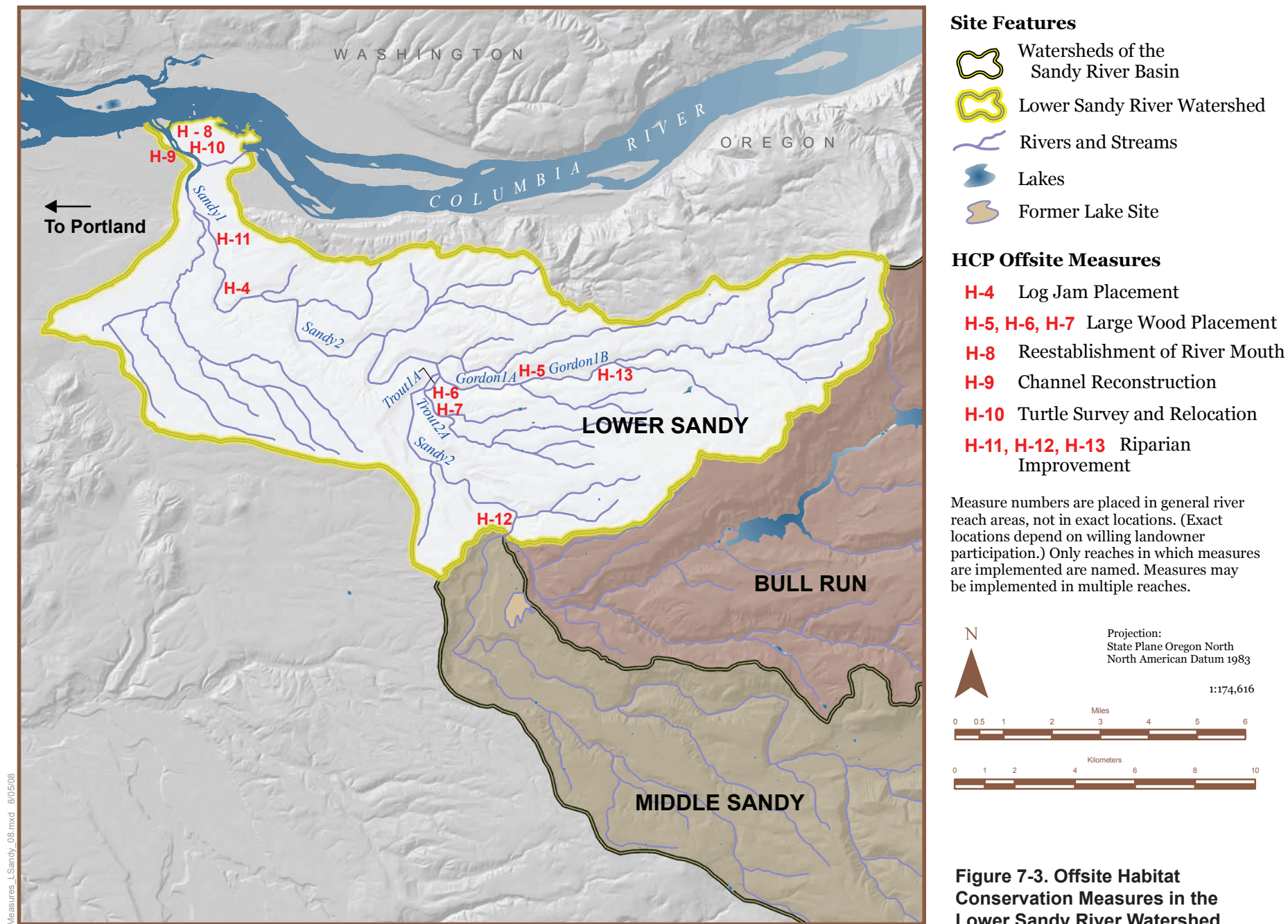
Table continued on next page.

Table 7-9. Offsite Habitat Conservation Measures in the Lower Sandy River Watershed, continued

#	Name	a) Habitat Attributes Affected ^a	Reaches Affected ^a	Time Frame for Implementation
		b) Historical Impacts in Bull Run Addressed c) Species Targeted for Primary Benefit ^b		
H-11	Sandy 1 Riparian Easement and Improvement	a) Riparian function, large wood b) Multiple c) Fall Chinook	Beaver 1A Sandy 1	Years 1-5
H-12	Sandy 2 Riparian Easement and Improvement	a) Riparian function, maximum water temperature, large wood b) Multiple c) Fall Chinook	Sandy 1 Sandy 2	Years 1-5
H-13	Gordon 1A and 1B Riparian Easement and Improvement	a) Fine sediment, backwater pools, large cobble/boulder riffles, primary pools, pool tailouts, small cobble/gravel riffles, riparian function, large wood b) Multiple c) Fall Chinook, winter steelhead	Gordon 1A Gordon 1B Sandy 2	Years 1-5

^a Because of the cumulative nature of the HCP measures, not all of the reaches in this table will have all of the habitat attribute effects listed here. For a reach-by-reach summary of the habitat attribute effects, see the tables in Chapter 8 or Appendix E.

^b See Chapter 8 for additional species benefits.



7.5.3 Habitat Conservation Measures in the Middle Sandy River Watershed

The middle Sandy River watershed functions primarily as a migration corridor for juvenile and adult salmonids, but also provides some spawning habitat for Chinook salmon and rearing habitat for a variety of resident and anadromous salmonids (Cramer and Associates 1998). Several dams and diversions in the middle Sandy have affected fish and fish habitat for many years. The former Marmot Dam, between reaches Sandy 5 and 6, influenced fish from the time of its construction in 1912 until it was decommissioned in 2007. ODFW constructed the Sandy River Fish Hatchery on Cedar Creek, along with the weir that blocks fish passage at RM 0.5, in the 1950s. Alder Creek, a tributary to the middle Sandy, has a municipal water diversion that supplies the city of Sandy, Oregon. This diversion creates a partial fish passage barrier and affects access for steelhead and coho.

The City's habitat conservation measures in the middle Sandy River watershed were developed considering the pending changes to the existing infrastructure described above. Marmot Dam was decommissioned in July 2007; the distribution of fish, as well as the habitat upstream and downstream of the dam site, may change with the dam removal. The riparian easements were planned to complement the improved fish passage expected from removal of Marmot Dam and the City's fish passage measures in Cedar and Alder creeks.

Riparian Easements and Improvements

The City has identified three habitat conservation measures for the middle Sandy River watershed that will improve riparian zone conditions. For these measures, the City will obtain land protection easements from willing landowners for a total of approximately 130 acres of riparian lands in the middle Sandy River watershed. The land easements will improve and protect 100 feet of riparian forest on either side of the average bankfull width of the river or creek. The riparian easements will extend 100 feet from the average bankfull width of the river. None of the areas has riparian zones that are in historical condition; the conservation measures include silvicultural practices to improve the riparian zones. The acreage totals for the land protection easements will be calculated by multiplying the lineal distance of the stream by the amount of riparian forest protected by the easement. The three riparian easement and improvement measures have been identified for specific stream reaches in the middle Sandy River.

Measure H-14—Sandy 3 Riparian Easement and Improvement: Within HCP Years 11–15, the City will acquire 100-foot-wide land protection easements from willing private landowners for at least 7 acres which will comprise the total number of lineal feet x 100 feet of riparian area on either side of the Sandy River in reach Sandy 3. At a minimum, the easements will be maintained for the term of the HCP. The City will also consider, on a voluntary and case-by-case basis, obtaining easements with durations longer than the term of the HCP and greater than 100 feet wide. The HCP funding for purchasing and maintaining each easement will be limited to what is defined in Chapter 11 of the HCP for that measure. The easement areas will be managed to support forest of ≥ 70 percent conifer trees (by canopy cover) where site conditions are conducive to the growth of conifers. Deciduous trees will be selectively thinned and replanted with conifers. If the easement area is not conducive to the growth of conifers, the area will be managed to support the growth of native hardwood species. Management of the easements will also include control of invasive plant species. See also Measures W-1 and W-2.

Measure H-15—Cedar 2 and 3 Riparian Easement and Improvement: Within HCP Years 6–10, the City will acquire 100-foot-wide land protection easements from willing private landowners for at least 49 acres which will comprise the total number of lineal feet x 100 feet of riparian area on either side of Cedar Creek in reaches Cedar 2 and Cedar 3. At a minimum, the easements will be maintained for the term of the HCP. The City will also consider, on a voluntary and case-by-case basis, obtaining easements with durations longer than the term of the HCP and greater than 100 feet wide. The HCP funding for purchasing and maintaining each easement will be limited to what is defined in Chapter 11 of the HCP for that measure. The easement areas will be managed to support forest of ≥ 70 percent conifer trees (by canopy cover) where site conditions are conducive to the growth of conifers. Deciduous trees will be selectively thinned and replanted with conifers. If the easement area is not conducive to the growth of conifers, the area will be managed to support the growth of native hardwood species. Management of the easements will also include control of invasive plant species. See also Measures W-1 and W-2.

Measure H-16—Alder 1A and 2 Riparian Easement and Improvement: Within HCP Years 1–5, the City will acquire 100-foot-wide land protection easements from willing private landowners for at least 43 acres which will comprise the total number of lineal feet x 100 feet of riparian area on either side of Alder Creek in reaches Alder 1A and Alder 2. At a minimum, the easements will be maintained for the term of the HCP. The City will also consider, on a voluntary and case-by-case basis, obtaining easements with durations longer than the term of the HCP and greater than 100 feet wide. The HCP funding for purchasing and maintaining each easement will be limited to what is defined in Chapter 11 of the HCP for that measure. The easement areas will be managed to support forest of ≥ 70 percent conifer trees (by canopy cover) where site conditions are conducive to the growth of conifers. Deciduous trees will be selectively thinned and replanted with conifers. If the easement area is not conducive to the growth of conifers, the area will be managed to support the growth of native hardwood species. Management of the easements will also include control of invasive plant species. See also Measures W-1 and W-2.

Acquisition of Surface Water Rights

Cedar Creek is a populated watershed with numerous privately-owned parcels and associated water rights for rural residential and agricultural purposes. The creek has elevated water temperatures in late summer partially due to the water withdrawals. The City will acquire water rights to improve water quality and baseflows in Cedar Creek for steelhead, coho, and cutthroat trout.

Measure F-5—Cedar Creek Purchase Water Rights: Within the first 10 years of the HCP term, the City will acquire approximately 50 percent of the current certificated surface water rights that affect summer flows on Cedar Creek. These water rights will be acquired from willing sellers and will be converted to instream use for at least the term of the HCP.

Fish Passage

Alder Creek, one of the larger tributaries to the middle Sandy River, currently supports steelhead and coho. The two fish passage conservation measures will provide access to 5.5 miles of good quality steelhead and coho habitat.

Measure P-2—Alder 1 Fish Passage: Within HCP Years 1-5, the City will modify the fish ladder under the Highway 26 bridge in reach Alder 1 to provide upstream and downstream volitional passage for steelhead and coho salmon. Passage design will be reviewed and approved in advance by NMFS.

Measure P-3—Alder 1A Fish Passage: Within HCP Years 1-5, the City will modify the City of Sandy water diversion weir at RM 1.7 of reach Alder 1A to provide upstream and downstream volitional passage for steelhead and coho. Passage design will be reviewed and approved in advance by NMFS.

Cedar Creek is one of the largest, low-gradient tributaries to the Sandy River. Historically, fish runs were significant in Cedar Creek and the stream supported fish camps (Russ Plaeger, personal communication, January 2007). Fish access to Cedar Creek has been blocked since the Sandy River Hatchery was constructed in the 1950s. The City's conservation measure, in conjunction with ODFW's commitments to fish passage on Cedar Creek, will provide passage to approximately 12–14 miles of stream habitat for coho, steelhead, and anadromous cutthroat trout.

Measure P-4—Cedar Creek 1 Fish Passage: Within HCP Years 1-5, the City will provide up to a maximum of \$3.7 million dollars to fund three components of fish passage improvements on Cedar Creek. The City will provide the money to ODFW to fund the following:

1. Upgrades to the Sandy Fish Hatchery water intake screens and associated features to conform to NMFS criteria
2. Passage improvements at the adult diversion ladder, downstream passage pipeline, and downstream plunge pool
3. Upgrades at the discharge channel to the plunge pool, the sluice gates, the diversion dam, and safety improvements for daily maintenance

The City will not provide money to fund the necessary water treatment improvements and any operations and maintenance costs that may be necessary for fish passage on Cedar Creek.

If ODFW cannot secure money for the other components necessary to implement this passage project, the City will redirect the \$3.7 million to the Habitat Fund to finance other capital projects in the Sandy River Basin. This reallocation will occur in consultation with NMFS and the Sandy River Basin Partners. The \$3.7 million will be

Measure description continued on next page.

Measure P-4, continued

reallocated in a manner (e.g., time frame) that will not adversely affect the City's water rate payers, as determined by the City.

The City will not be responsible for monitoring fish passage on Cedar Creek after the improvements have been made. The City assumes that ODFW will be responsible for monitoring, treatment, and operation and maintenance.

Large Wood

Measure H-17—Cedar 2 and 3 LW Placement: Within HCP Years 6-10, the City will work with willing landowners to place a minimum of 600 key logs along the entire length of reaches Cedar 2 and 3, at approximately 75 pieces per mile. Individual LW pieces will be sound conifer logs with a small-end diameter of at least 12 inches and a length of at least 30 feet. The key pieces will be placed to collect other additional woody debris. If available, large root wads will also be selected for placement. Artificial anchoring of the wood will only be used when wood movement cannot be tolerated. Anchoring will only be used if the large wood might move downstream and damage road culverts, bridges, private property, or other streamside improvements. It is desirable for the stream to redistribute the placed large wood to some extent, as long as damage is avoided. Methods and timing for LW placement will be determined in consultation with the NMFS and ODFW.

The LW placement in Cedar Creek will be maintained for 15 years. Year 1 of the maintenance will be the calendar year following the wood placement.

Table 7-9 is a summary of the seven habitat conservation measures in the middle Sandy River watershed. Figure 7-4 is a map showing the location of Measures H-14 through H-17, F-5, and P-2 through P-4.

Table 7-10. Offsite Habitat Conservation Measures in the Middle Sandy River Watershed

#	Measure Name	a) Habitat Attributes Affected ^a b) Historical Impacts in Bull Run Addressed c) Species Targeted for Primary Benefit ^b	Reaches Affected ^a	Time Frame for Implementation
F-5	Cedar Creek Purchase Water Rights	a) Dissolved oxygen, fish pathogens, minimum and maximum water temperature, temperature moderation by groundwater b) Multiple c) Winter steelhead, coho, cutthroat trout	Cedar 1 Cedar 2 Cedar 3	Years 6-10
H-14	Sandy 3 Riparian Easement and Improvement	a) Riparian function, maximum water temperature, large wood b) Multiple c) Spring Chinook, winter steelhead, coho	Sandy 3	Years 11-15
H-15	Cedar 2 and 3 Riparian Easement and Improvement	a) Off-channel habitat, riparian function, large wood b) Multiple c) Winter steelhead, coho, cutthroat trout	Cedar 2 Cedar 3	Years 6-10
H-16	Alder 1A and 2 Riparian Easement and Improvement	a) Large wood, riparian function b) Multiple c) Winter steelhead, coho, cutthroat trout	Alder 1 Alder 1A Alder 2	Years 1-5
H-17	Cedar 2 and 3 LW Placement	a) Large wood, beaver ponds, primary pools b) Multiple c) Winter steelhead, coho, cutthroat trout	Cedar 2 Cedar 3	Years 6-10
P-2 P-3	Alder 1 Fish Passage Alder 1A Fish Passage	a) Fish Access b) Blocked access to spawning and rearing habitat c) Winter steelhead, coho, cutthroat trout	Alder 1 Alder 1A	Years 1-5
P-4	Cedar Creek Fish Passage	a) Fish Access b) Blocked access to spawning and rearing habitat c) Winter steelhead, coho, cutthroat trout	Cedar 1 Cedar 2 Cedar 3 Cedar 4	Years 1-5

^a Although the HCP measures can affect multiple habitat attributes and have effects in multiple reaches, not every habitat attribute will be affected in each reach. For a reach-by-reach summary of the habitat attribute effects, see the tables in Chapter 8 or Appendix E.

^b See Chapter 8 for additional species benefits

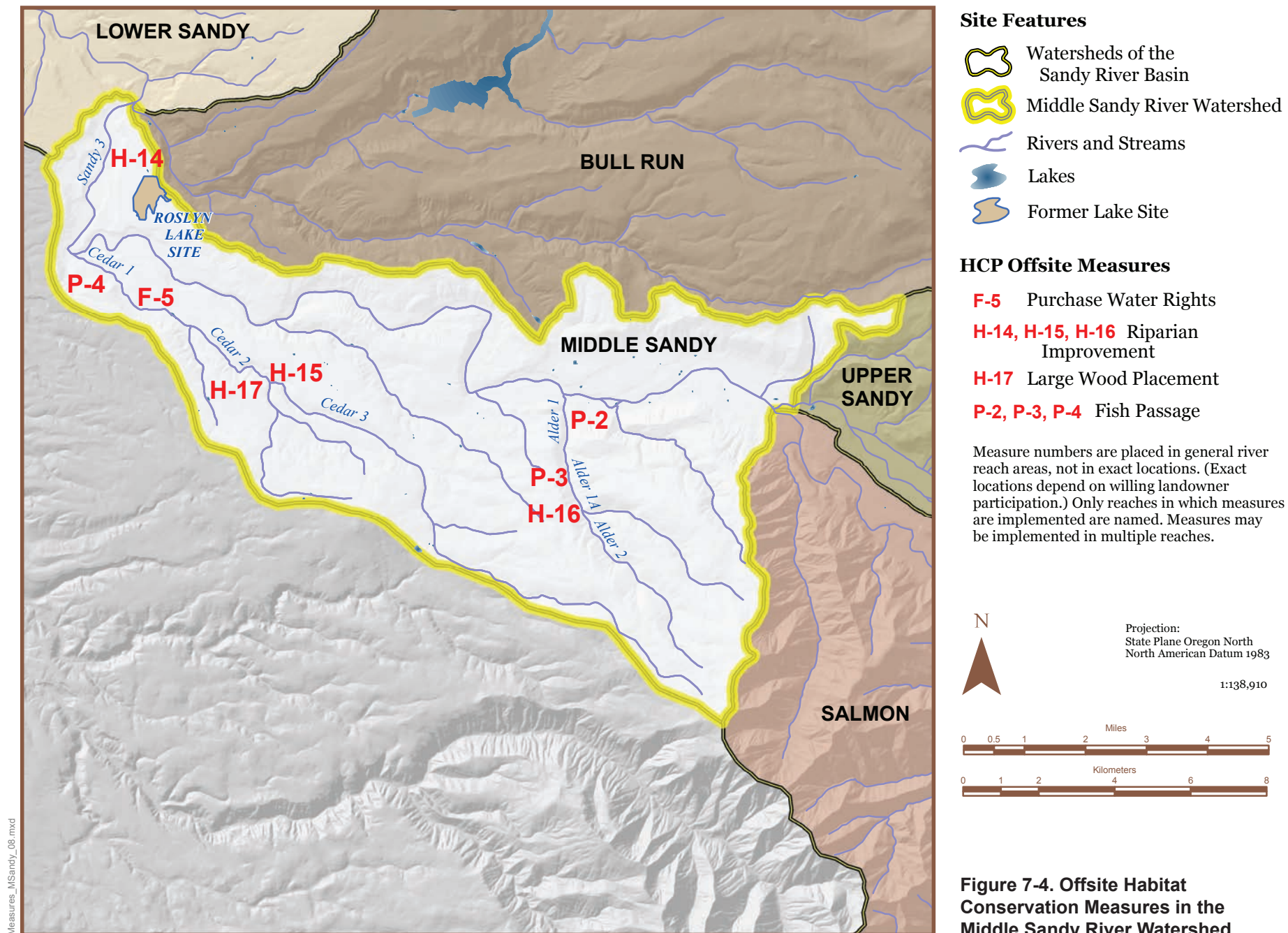


Figure 7-4. Offsite Habitat Conservation Measures in the Middle Sandy River Watershed

7.5.4 Habitat Conservation Measures in the Upper Sandy River Watershed

Compared with the other watersheds in the Sandy River Basin, the upper Sandy River watershed contains the most stream miles of habitat currently used by anadromous fish in the Sandy River Basin Characterization Report (SRBP 2005). Spring Chinook, coho salmon, and steelhead use the upper watershed for spawning and rearing. Fall Chinook and sea-run cutthroat trout historically used the upper Sandy, but did not pass Marmot Dam in the middle Sandy. The upper Sandy River watershed originates high on the flanks of Mount Hood and the upper Sandy River receives high turbidity from the mountain glaciers during the summer months. Streamflow from the glaciers also provide cool water temperatures for migratory fish seeking clear water spawning tributaries. The City identified one habitat conservation measure to improve habitat for spring Chinook, steelhead, and coho salmon on the mainstem of the upper Sandy River.

Riparian Easement and Improvement

The City's land easement measure in the upper Sandy will improve and protect 100 feet of riparian forest on either side of the active channel width of the river. This measure includes silvicultural practices to improve the riparian zones, which will eventually result in improved habitat diversity through LW recruitment.

Measure H-18—Sandy 8 Riparian Easement and Improvement: Within HCP Years 11–15, the City will acquire 100-foot-wide land protection easements from willing private landowners for at least 25 acres, which will comprise the total number of lineal feet x 100 feet of riparian area on either side of the upper Sandy River in reach Sandy 8. At a minimum, the easements will be maintained for the term of the HCP. The City will also consider, on a voluntary and case-by-case basis, obtaining easements with durations longer than the term of the HCP and greater than 100 feet wide. The HCP funding for purchasing and maintaining each easement will be limited to what is defined in Chapter 11 of the HCP for that measure. The easement areas will be managed to support forest of ≥ 70 percent conifer trees (by canopy cover) where site conditions are conducive to the growth of conifers. Deciduous trees will be selectively thinned and replanted with conifers. If the easement area is not conducive to the growth of conifers, the area will be managed to support the growth of native hardwood species. Management of the easements will also include control of invasive plant species. See also Measures W-1 and W-2.

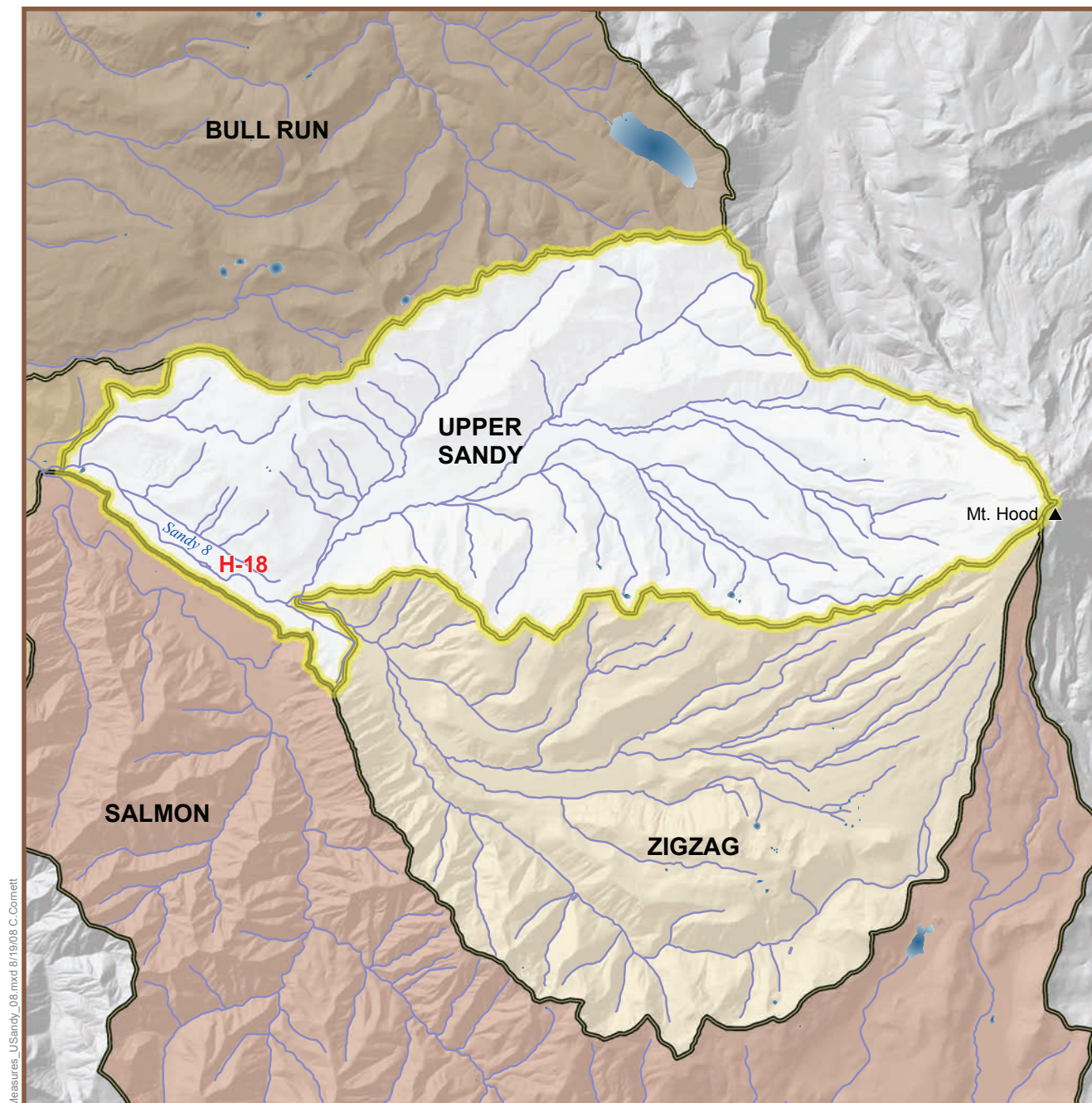
Table 7-10 summarizes the habitat conservation measure in the upper Sandy River watershed. Figure 7-5 is a map showing the location of Measure H-18.

Table 7-11. Offsite Habitat Conservation Measure in the Upper Sandy River Watershed

#	Name	a) Habitat Attributes Affected ^a	Reaches Affected ^a	Time Frame for Implementation
		b) Historical Impacts in Bull Run Addressed		
		c) Species Targeted for Primary Benefit ^b		
H-18	Sandy 8 Riparian Easement and Improvement	a) Maximum water temperature, riparian function, large wood b) Multiple c) Spring Chinook, winter steelhead	Sandy 7 Sandy 8	Years 11-15





^a Because of the cumulative nature of the HCP measures, not all of the reaches in this table will have all of the habitat attribute effects listed here. For a reach-by-reach summary of the habitat attribute effects, see the tables in Chapter 8 or Appendix E.

^b See Chapter 8 for additional species benefits.



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Site Features

-  Watersheds of the Sandy River Basin
-  Upper Sandy River Watershed
-  Rivers and Streams
-  Lakes

HCP Offsite Measures

H-18 Riparian Improvement

Measure numbers are placed in general river reach areas, not in exact locations. (Exact locations depend on willing landowner participation.) Only reaches in which measures are implemented are named. Measures may be implemented in multiple reaches.

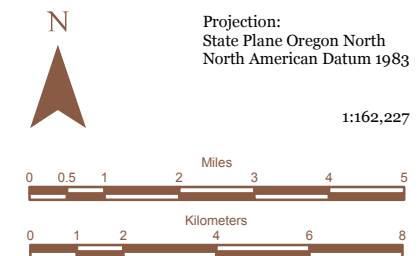


Figure 7-5. Offsite Habitat Conservation Measure in the Upper Sandy River Watershed

7.5.5 Habitat Conservation Measures in the Salmon River Watershed

The Salmon River provides some of the most diverse and productive salmon and steelhead habitat in the Sandy River Basin. The Salmon River usually runs clear all year and provides miles of spawning and rearing habitat for spring Chinook, steelhead, and coho, as well as a migration corridor for fish to its smaller tributaries. Final Falls, at RM 14, is the upstream limit of anadromous fish distribution. Historically, the Salmon River also provided spawning habitat for fall Chinook, coastal cutthroat trout, and other species. The City's habitat conservation measures in the Salmon River watershed focus on actions that produce both short- and long-term habitat benefits for fish.

Riparian Easements and Improvements

The City has identified habitat conservation measures for the Salmon River watershed to improve riparian zone conditions. The City will obtain land protection easements from willing landowners for a total of approximately 85 acres of riparian lands in the Salmon River watershed. The land easements will improve and protect 100 feet of riparian forest on either side of the active channel width of the river or creeks. None of the areas has riparian zones that are in historical condition. The conservation measures include silvicultural practices to improve the riparian zones. The acreage totals for the land protection easements will be calculated by multiplying the lineal distance of the stream by the amount of riparian forest protected by the easement.

Measure H-19—Salmon 1 Riparian Easement and Improvement: Within HCP Years 6–10, the City will acquire 100-foot-wide land protection easements from willing private landowners for at least 23 acres, which will comprise the total number of lineal feet x 100 feet of riparian area on either side of the Salmon River in reach Salmon 1. At a minimum, the easements will be maintained for the term of the HCP. The City will also consider, on a voluntary and case-by-case basis, obtaining easements with durations longer than the term of the HCP and greater than 100 feet wide. The HCP funding for purchasing and maintaining each easement will be limited to what is defined in Chapter 11 of the HCP for that measure. The easement areas will be managed to support forest of ≥ 70 percent conifer trees (by canopy cover) where site conditions are conducive to the growth of conifers. Deciduous trees will be selectively thinned and replanted with conifers. If the easement area is not conducive to the growth of conifers, the area will be managed to support the growth of native hardwood species. Management of the easements will also include control of invasive plant species. See also Measures W-1 and W-2.

Measure H-20—Salmon 2 Riparian Easement and Improvement: Within HCP Years 11–15, the City will acquire 100-foot-wide land protection easements from willing private landowners for at least 36 acres which will comprise the total number of lineal feet x 100 feet of riparian area on either side of the Salmon River in reach Salmon 2. At a minimum, the easements will be maintained for the term of the HCP. The City will also consider, on a voluntary and case-by-case basis, obtaining easements with durations longer than the term of the HCP and greater than 100 feet wide. The HCP funding for purchasing and maintaining each easement will be limited to what is defined in Chapter 11 of the HCP for that measure. The easement areas will be managed to support forest of ≥ 70 percent conifer trees (by canopy cover) where site conditions are conducive to the growth of conifers. Deciduous trees will be selectively thinned and replanted with conifers. If the easement area is not conducive to the growth of conifers, the area will be managed to support the growth of native hardwood species. Management of the easements will also include control of invasive plant species. See also Measures W-1 and W-2.

Measure H-21—Salmon 3 Riparian Easement and Improvement: Within HCP Years 11–15, the City will acquire 100-foot-wide land protection easements from willing private landowners for at least 12 acres which will comprise the total number of lineal feet x 100 feet of riparian area on either side of the Salmon River in reach Salmon 3. At a minimum, the easements will be maintained for the term of the HCP. The City will also consider, on a voluntary and case-by-case basis, obtaining easements with durations longer than the term of the HCP and greater than 100 feet wide. The HCP funding for purchasing and maintaining each easement will be limited to what is defined in Chapter 11 of the HCP for that measure. The easement areas will be managed to support forest of ≥ 70 percent conifer trees (by canopy cover) where site conditions are conducive to the growth of conifers. Deciduous trees will be selectively thinned and replanted with conifers. If the easement area is not conducive to the growth of conifers, the area will be managed to support the growth of native hardwood species. Management of the easements will also include control of invasive plant species. See also Measures W-1 and W-2.

Measure H-22—Boulder 1 Riparian Easement and Improvement: Within HCP Years 1–5, the City will acquire 100-foot-wide land protection easements from willing private landowners for at least 15 acres which will comprise the total number of lineal feet x 100 feet of riparian area on either side of Boulder Creek in reach Boulder 1. At a minimum, the easements will be maintained for the term of the HCP. The City will also consider, on a voluntary and case-by-case basis, obtaining easements with durations longer than the term of the HCP and greater than 100 feet wide. The HCP funding for purchasing and maintaining each easement will be limited to what is defined in Chapter 11 of the HCP for that measure. The easement areas will be managed to support forest of ≥ 70 percent conifer trees (by canopy cover) where site conditions are conducive to the growth of conifers. Deciduous trees will be selectively thinned and replanted with conifers. If the easement area is not conducive to the growth of conifers, the area will be managed to support the growth of native hardwood species. Management of the easements will also include control of invasive plant species. See also Measures W-1 and W-2.

Land Acquisition and Channel Redesign

Artificially confined banks, degraded riparian function, and reduced large wood are all major factors limiting Chinook, coho, and steelhead in reach Salmon 2. Restoration of the Miller Quarry site will add side channel habitat, improve riparian function, and increase large wood to the channel, which will improve habitat diversity for spawning and rearing fish.

Measure H-23—Salmon 2 Miller Quarry Acquisition: Within HCP Years 6–10, the 40-acre Miller Quarry parcel in reach Salmon 2 will be purchased. The restoration commitments are described in Measure H-24 below.

Measure H-24—Salmon 2 Miller Quarry Restoration: Within HCP Years 11–15, the City will remove riprap along 0.25 mile of river front of the Miller Quarry parcel to reconnect floodplain and side-channel habitat. Approximately 1,000 feet of new side channel will be opened. 160 pieces of LW will be placed in the side channel to create approximately eight log jams. Approximately four acres of riparian zone will be amended with soil and then replanted with suitable riparian species.

Salmon Carcass Placement

Salmon carcasses have been added to streams in the Sandy River Basin since 2001 in an annual effort to enhance in-stream productivity and benefit fish. The City will contribute to this ongoing project with carcass placements in reach Salmon 2 that are designed to return benefits in the stream quickly.

Measure H-25—Salmon 2 Carcass Placement: Within HCP Years 6–10, the City will provide funding, for one season, to place at least 1,800 salmon carcasses (approximately 300 carcasses per mile) in reach 2 of the Salmon River. The carcass placement will be implemented as part of a basin-wide partnership project by ODFW, USFS, and the Sandy River Basin Watershed Council. This measure will only occur during one year and the City will work with the Partners to determine the best timing and method for implementation of the measure, which will depend on available carcasses at ODFW's hatchery facilities and other considerations.

Large Wood

Large wood placed in Boulder Creek will form pools, provide cover, and retain gravel. These habitat attributes will accrue relatively quickly, providing benefits primarily for steelhead and coho.

Measure H-26 Boulder 0 and 1 LW Placement: Within HCP Years 1-5, the City will work with willing landowners to place a minimum of 65 key logs along the entire length of reaches Boulder 0 and 1. Individual LW pieces will be sound conifer logs with a small-end diameter of at least 12 inches and a length of at least 30 feet. The key pieces will be placed to collect other additional woody debris. If available, large root wads will also be selected for placement. Artificial anchoring of the wood will only be used when wood movement cannot be tolerated. Anchoring will only be used if the large wood may move downstream and damage road culverts, bridges, private property, or other streamside improvements. It is desirable for the stream to redistribute the placed large wood to some extent, as long as damage is avoided. Methods and timing for LW placement will be determined in consultation with NMFS and ODFW.

The LW placement in Boulder Creek will be maintained for 15 years. Year 1 of the maintenance will be the calendar year following the wood placement.

Table 7-11 is a summary of the eight habitat conservation measures in the Salmon River watershed. Figure 7-6 is a map showing the locations of Measures H-24 through H-26.

Table 7-12. Offsite Habitat Conservation Measures in the Salmon River Watershed

#	Name	a) Habitat Attributes Affected ^a b) Historical Impacts in Bull Run Addressed c) Species Targeted for Primary Benefit ^b	Reaches Affected ^a	Time Frame for Implementation
H-19	Salmon 1 Riparian Easement and Improvement	a) Off-channel habitat, small cobble/gravel riffles, riparian function, large wood b) Multiple c) Spring Chinook, winter steelhead, coho	Salmon 1	Years 6-10
H-20	Salmon 2 Riparian Easement and Improvement	a) Riparian function, maximum water temperature, large wood b) Multiple c) Spring Chinook, winter steelhead, coho	Salmon 1 Salmon 2	Years 11-15
H-21	Salmon 3 Riparian Easement and Improvement	a) Large wood, riparian function b) Multiple c) Spring Chinook, winter steelhead, coho	Salmon 2 Salmon 3	Years 11-15
H-22	Boulder 1 Riparian Easement and Improvement	a) Fine sediment , maximum water temperature, large wood, riparian function b) Multiple c) Spring Chinook, winter steelhead, coho	Boulder 0 Boulder 1 Salmon 1	Years 1-5
H-23	Salmon 2 Miller Quarry Acquisition	a) Bed scour, artificial confinement, off-channel habitat, riparian function, large wood b) Multiple c) Spring Chinook, winter steelhead, coho	Salmon 2	Years 6-10

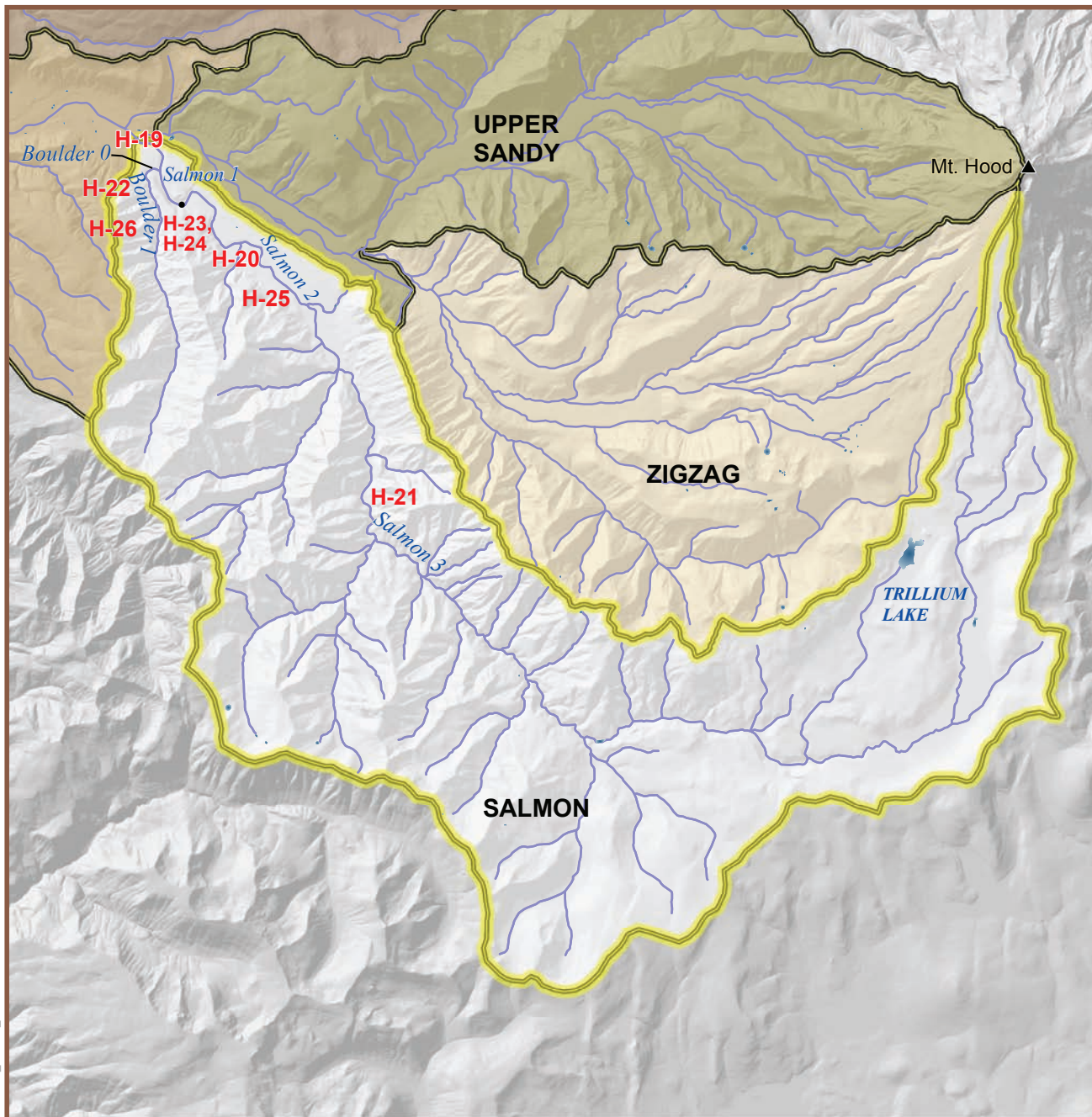
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Table 7-12. Offsite Habitat Conservation Measures in the Salmon River Watershed, continued





#	Name	a) Habitat Attributes Affected ^a	Reaches Affected ^a	Time Frame for Implementation
		b) Historical Impacts in Bull Run Addressed c) Species Targeted for Primary Benefit ^b		
H-24	Salmon 2 Miller Quarry Restoration	a) Bed scour, artificial confinement , off-channel habitat , riparian function, large wood b) Multiple c) Spring Chinook, winter steelhead, coho	Salmon 2	Years 11-15
H-25	Salmon 2 Carcass Placement	a) Salmon carcasses b) Blocked access to habitat for spawning c) Spring Chinook, winter steelhead, coho	Salmon 1 Sandy 7	Years 6-10
H-26	Boulder 0 and 1 LW Placement	a) Large wood b) Reduced instream habitat complexity c) Spring Chinook, winter steelhead, coho	Boulder 0 Boulder 1 Salmon 1 Sandy 7	Years 1-5

^a Because of the cumulative nature of the HCP measures, not all of the reaches in this table will have all of the habitat attribute effects listed here. For a reach-by-reach summary of the habitat attribute effects, see the tables in Chapter 8 or Appendix E.

^b See Chapter 8 for additional species benefits



Site Features

-  Watersheds of the Sandy River Basin
-  Salmon River Watershed
-  Rivers and Streams
-  Lakes

HCP Offsite Measures

- H-19, H-20, H-21, H-22** Riparian Improvement
- H-23** Miller Quarry Acquisition
- H-24** Miller Quarry Restoration
- H-25** Carcass Placement
- H-26** Large Wood Placement

Measure numbers are placed in general river reach areas, not in exact locations. (Exact locations depend on willing landowner participation.) Only reaches in which measures are implemented are named. Measures may be implemented in multiple reaches.

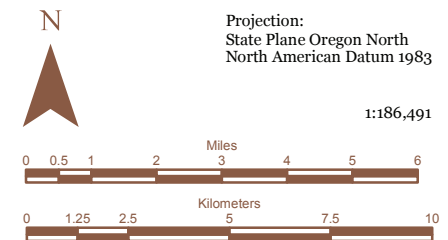


Figure 7-6. Offsite Habitat Conservation Measures in the Salmon River Watershed

7.5.6 Habitat Conservation Measures in the Zigzag River Watershed

Spring Chinook, steelhead, and coho use most of the stream miles available to anadromous fish in the Zigzag River watershed. Although turbidity from glacial melt may limit production potential in some reaches, the Zigzag also provides passage to its clear water tributaries, such as Still Creek. The mainstem channel in the lower Zigzag was deepened and straightened after floods in 1964 and 1972. These flood control measures eliminated natural meanders, oxbows, and side channels. The City's channel modification and riparian measures in the lower Zigzag River will reestablish natural stream conditions for spawning and rearing anadromous fish.

Channel Modification

The channel modification planned for Zigzag reach 1A will create more natural channel conditions, including riparian areas that mimic natural gradients, connecting the river with natural flood plains. Installation of LW will allow for gravel recruitment and pool formation.

Measure H-27—Zigzag 1A Channel Design: Within HCP Years 11–15, the City will work with willing landowners to modify Zigzag 1A to create more natural channel conditions. Approximately one-half mile of new side channel will be created and an additional one-half mile of existing side channel will be improved. A minimum of 270 pieces of large wood will be placed in the side channel and mainstem of Zigzag 1A.

Riparian Easements and Improvements

The City has identified one habitat conservation measure for the Zigzag River watershed that will improve riparian zone conditions. The City will obtain land protection easements from willing landowners for a total of approximately 12 acres of riparian lands in the Zigzag River watershed. The land easements will improve and protect 100 feet of riparian forest on either side of the active channel width of the river or creeks. Riparian conditions in this area are degraded from historical conditions. The acreage totals for the land protection easements will be calculated by multiplying the lineal distance of the stream by the amount of riparian forest protected by the easement.

Measure H-28—Zigzag 1A and 1B Riparian Easement and Improvement: Within HCP Years 11–15, the City will acquire 100-foot-wide land protection easements from willing private landowners for at least 12 acres which will comprise the total number of lineal feet x 100 feet of riparian area on either side of Zigzag River in reaches Zigzag 1A and 1B. At a minimum, the easements will be maintained for the term of the HCP. The City will also consider, on a voluntary and case-by-case basis, obtaining easements with durations longer than the term of the HCP and greater than 100 feet wide. The HCP funding for purchasing and maintaining each easement will be limited to what is defined in Chapter 11 of the HCP for that measure. The easement areas will be managed to support forest of ≥ 70 percent conifer trees (by canopy cover) where site conditions are conducive to the growth of conifers. Deciduous trees will be selectively thinned and replanted with conifers. If the easement area is not conducive to the growth of conifers, the area will be managed to support the growth of native hardwood species. Management of the easements will also include control of invasive plant species. See also Measures W-1 and W-2.

Salmon Carcass Placements

The salmon carcasses will be added to the Zigzag reaches as part of an annual basin-wide effort to enhance in-stream productivity and benefit fish. The City's efforts are designed to quickly return benefits in the Zigzag River and downstream.

Measure H-29—Zigzag 1A, 1B, and 1C Carcass Placement: Within HCP Years 11–15, the City will provide funding, for one season, to place at least 1,800 salmon carcasses (approximately 300 carcasses per mile) in reaches Zigzag 1A, 1B, and 1C. The carcass placement will be implemented as part of a basin-wide partnership project by ODFW, USFS and the Sandy River Basin Watershed Council. This measure will occur during one year only and the City will work with the Partners to determine the best timing and method for implementation of the measure, which will depend on available carcasses at ODFW's hatchery facilities and other considerations.

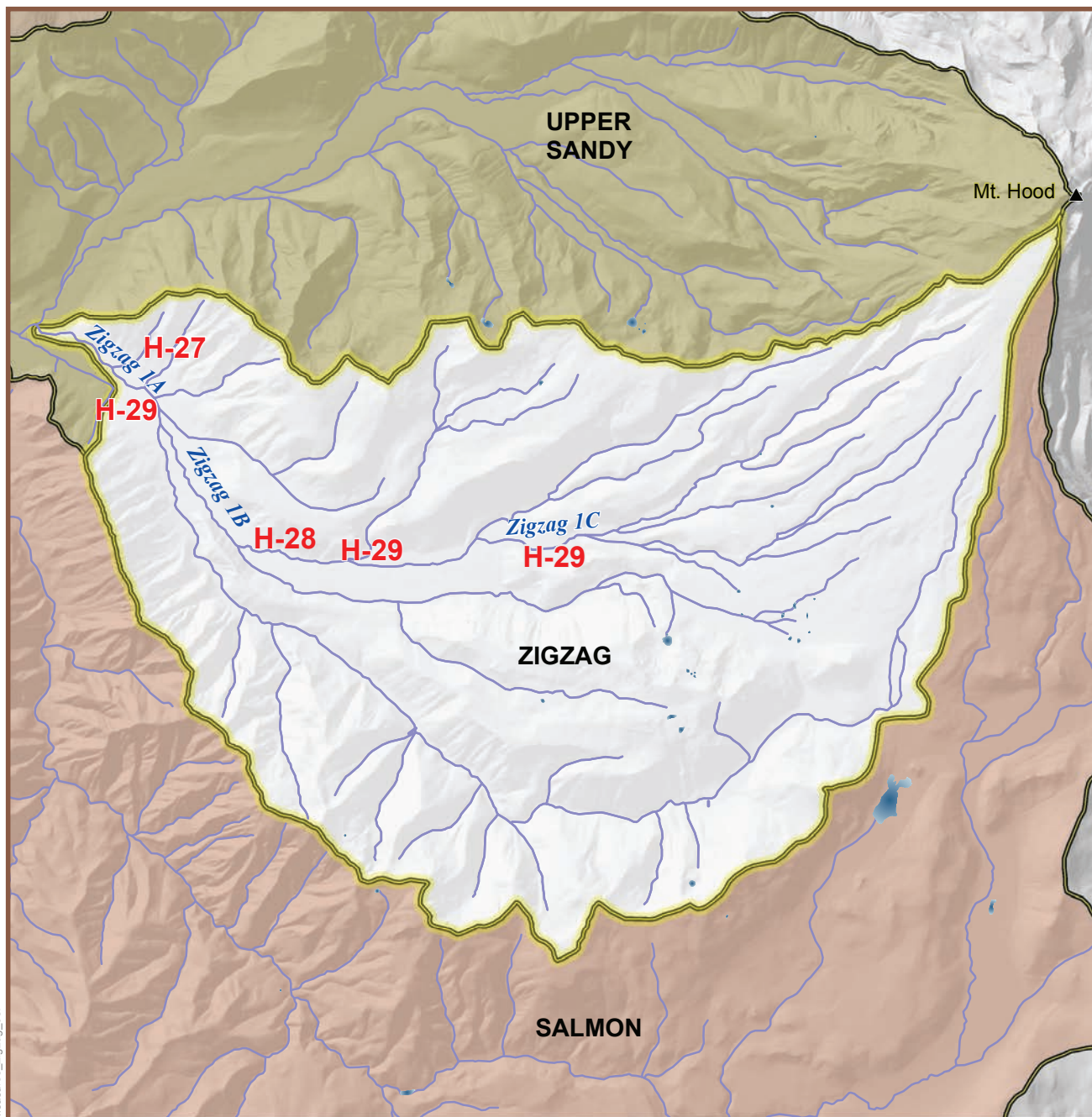
Table 7-13 is a summary of the three habitat conservation measures in the Zigzag River watershed. Figure 7-7 is a map showing the locations of Measures H-27 through H-29.

Table 7-13. Offsite Habitat Conservation Measures in the Zigzag River Watershed





#	Name	a) Habitat Attributes Affected ^a b) Historical Impacts in Bull Run Addressed c) Species Targeted for Primary Benefit ^b	Reaches Affected ^a	Time Frame for Implementation
H-27	Zigzag 1A Channel Design	a) Large wood, artificial confinement, large cobble/boulder riffles, off-channel habitat b) Multiple c) Spring Chinook, winter steelhead, coho	Sandy 8 Zigzag 1A	Years 11-15
H-28	Zigzag 1A and 1B Riparian Easement and Improvement	a) Large wood, harassment, riparian function b) Multiple c) Spring Chinook, winter steelhead, coho	Sandy 8 Zigzag 1A Zigzag 1B	Years 11-15
H-29	Zigzag 1A, 1B, and 1C Carcass Placement	a) Salmon carcasses b) Blocked access to habitat for spawning c) Spring Chinook, winter steelhead, coho	Sandy 8 Zigzag 1A Zigzag 1B Zigzag 1C	Years 11-15

^aBecause of the cumulative nature of the HCP measures, not all of the reaches in this table will have all of the habitat attribute effects listed here. For a reach-by-reach summary of the habitat attribute effects, see the tables in Chapter 8 or Appendix E.

^bSee Chapter 8 for additional species benefits.



Site Features

-  Watersheds of the Sandy River Basin
-  Zigzag River Watershed
-  Rivers and Streams
-  Lakes

HCP Offsite Measures

- H-27** Channel Design
- H-28** Riparian Improvement
- H-29** Carcass Placement

Measure numbers are placed in general river reach areas, not in exact locations. (Exact locations depend on willing landowner participation.) Only reaches in which measures are implemented are named. Measures may be implemented in multiple reaches.

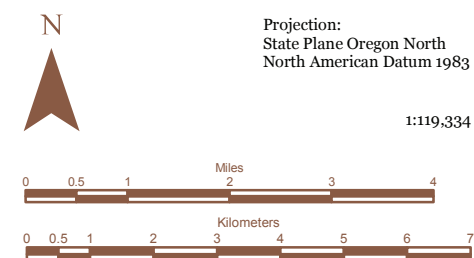


Figure 7-7. Offsite Habitat Conservation Measures in the Zigzag River Watershed

7.6 Habitat Fund

The Habitat Fund was designed to enable adaptive management, to address water system impacts not otherwise fully addressed, to contribute to partnership projects, and to respond to future opportunities not yet known. The Habitat Fund is divided into two portions: adaptive management and partnership projects. The adaptive management portion of the Habitat Fund will be used to implement additional habitat projects if one or more of the offsite measures (described in Section 7.5) does not meet its objectives. Section 9.4 provides more information on the adaptive management approach. The "partnership" portion of the Habitat Fund will be used to implement additional habitat projects that help compensate for water system impacts not fully addressed by the other projects in this chapter of the HCP (e.g., benchmark comparison for steelhead shown in Table 8-38). Project selection will be guided by the Sandy Basin Habitat Restoration Strategy (see Section 9.4.1). The priority for this portion of the fund is to implement partnership projects that also rely on matching funds obtained by other partners. The partnership approach helps build support for larger, more challenging projects and can increase the probability that these projects can be implemented. Frequently, partners are not able to successfully obtain grant funds or federal budget allocations if local matching money is not available. When appropriate, the Habitat Fund will be used to match funds obtained by partners. Projects funded with these resources can also take advantage of specific opportunities to meet City habitat improvement objectives that might not have been known at the time the HCP was developed. Overall, the intent of the Habitat Fund is to help improve the basin's fish populations, compensate for water system impacts, and to help meet the City's commitment to contribute to fish recovery (e.g., City Council Resolution 37715).

Measure H-30—Habitat Fund: The City will provide money to create a Habitat Fund of \$9 million. A \$5-million portion of the Habitat Fund is available in four increments prior to HCP Year 20 and is dedicated to partnership projects. The increments are described in Chapters 9 and 11 (see also Figure 11-1). The remaining \$4 million is dedicated to adaptive management needs but will be used for additional partnership projects if not needed for adaptive management (see Chapters 9 and 11). Projects will be selected in consultation with the HCP Implementation Committee (see Chapter 9) and will be guided by the Sandy River Basin Restoration Strategy. The City and NMFS will make the final project selection decisions.

Of the \$5 million, the City will specifically dedicate \$1.7 million toward habitat enhancement projects on the Salmon River to be implemented jointly by the Sandy River Basin Partners, and with additional funds from the Partners and/or from grants. If partnership funds cannot be obtained to implement these projects, the City funds will be used for other projects in the Sandy River Basin.

Based on an informal agreement in October 2004, the City will also work with the Partners to provide resources from the \$5-million portion of the Habitat Fund to (1) participate in basin-wide efforts to control invasive plants that threaten riparian habitat, and (2) build the organizational capacity of the Partners to implement the basin-wide Restoration Strategy, including outreach.

7.7 Terrestrial Wildlife Habitat Conservation Measures

Impacts to northern spotted owls, bald eagles, and fishers are expected to be rare because of the well-established nature of water supply facilities and activities in the Bull Run watershed, and the low numbers of spotted owls, bald eagles, and fishers in the Sandy River Basin. The potential for disturbance does exist, however, and these measures will minimize the related impacts.² The HCP Objectives that guide these measures are the following:

- Avoid or minimize periodic temporary disturbance of habitat (for species both covered or addressed in the HCP) that might otherwise result from routine operation, maintenance, and repair of water supply facilities
- Avoid or minimize periodic temporary disturbance of habitat (for species both covered or addressed in the HCP) that might otherwise result from implementation of the HCP habitat conservation measures

7.7.1 Spotted Owl Measure

Measure W-1—Minimize Impacts to Nesting Spotted Owls: For the term of the HCP, the City will take the following steps to avoid or minimize impacts to nesting spotted owls on all covered lands as described in Chapter 3:

A. Activities with Little or No Potential to Adversely Affect Nesting Spotted Owls:

Spotted owls rarely nest near roads or other openings in the forest, so the use, maintenance and minor repair of existing project facilities and roads has little or no potential to disrupt nesting spotted owls. The following covered activities will be allowed to occur on the covered lands without restrictions for spotted owls:

- Operation, maintenance and repair of the water system as described in HCP Section 3.4.1, other than activities described in Items B through F below
- Implementation of the habitat conservation, research and monitoring measures described in this HCP, other than activities described in Items B through F below
- Performance of incidental land management activities as described in Section 3.4.4 of this HCP, other than activities described in Items B through E below
- Use of roads by vehicles and humans on foot
- Mowing and cutting of roadside brush
- Cleaning and maintenance of roadside ditches
- Grading of road surfaces
- Patching of asphalt road surfaces

Measure description continued on next page.

²In 2007, the bald eagle was delisted as a threatened species under the Endangered Species Act. The City has used the guidelines developed by the U.S. Fish and Wildlife Service (2007b) as the basis for Measure W-2.

Measure W-1 continued

- Spot patching of other road surfaces
- Sealing of road surface cracks
- Application of chip seal to asphalt roads
- Maintenance of water bars and other road drainage features
- Cleaning and repair of road culverts, replacement of road culverts lasting seven days or less
- Replacement of bridges lasting seven days or less, and not involving pile driving or blasting
- Maintenance and repair of project powerlines
- Mowing of shrubs and small trees on power line rights-of-way

B. Activities with the Potential to Disrupt Nesting Spotted Owls Within 200 Feet: The following activities have the potential to disrupt nesting spotted owls up to 200 feet away.

- Replacement of road culverts lasting more than seven days
- Replacement of bridges lasting more than seven days
- Road reconstruction
- Use of pile drivers
- Removal of trees from along the powerlines in the rights-of-way

These activities may occur without restrictions for spotted owls between July 1 and February 28. If they occur between March 1 and June 30 (the period when nesting spotted owls and their young may be restricted to the immediate vicinity of the nest), the City will evaluate all forest within 200 feet of the proposed activity to determine whether it is suitable spotted owl nesting habitat. If no suitable nesting habitat is found, the activity may occur. If suitable nesting habitat is found within 200 feet of the proposed activity, it will be surveyed for the presence of nesting spotted owls. If no nesting owls are found, the activity may occur. If nesting spotted owls are found within 200 feet of the proposed activity, the activity will not occur until after June 30, unless it is part of an emergency action as described below. When surveys for nesting spotted owls are conducted and no evidence of nesting is found, the results of those surveys will be considered adequate for the breeding season (year) in which they are conducted and the following breeding season (year) as well.

C. Activities with the Potential to Disrupt Nesting Spotted Owls Within 0.25 Mile: The following activities have the potential to disrupt nesting spotted owls up to 0.25 mile away.

- Use of helicopters at altitudes of 500 feet above the tree line
- Operation of rock crushers

These activities may occur without restrictions for spotted owls between July 1 and February 28. If they occur between March 1 and June 30, the City will evaluate all forest

Measure description continued on next page.

Measure W-1 continued

within 0.25 mile of the proposed activity to determine whether it is suitable spotted owl nesting habitat. If no suitable nesting habitat is found, the activity may occur. If suitable nesting habitat is found within 0.25 mile of the proposed activity, it will be surveyed for the presence of nesting spotted owls. If no nesting owls are found, the activity may occur. If nesting spotted owls are found within 0.25 mile of the proposed activity, the activity will not occur until after June 30, unless it is part of an emergency action as described below. When surveys for nesting spotted owls are conducted and no evidence of nesting is found, the results of those surveys will be considered adequate for the breeding season (year) in which they are conducted and the following breeding season (year) as well.

D. Activities with the Potential to Disrupt Nesting Spotted Owls Within 1.0 Mile: The following activity has the potential to disrupt nesting spotted owls up to 1.0 mile away:

- Blasting

This activity may occur without restrictions for spotted owls between October 1 and February 28. If it occurs between March 1 and September 30 (the spotted owl nesting season), the City will evaluate all forest within 1.0 mile of the proposed activity to determine whether it is suitable spotted owl nesting habitat. If no suitable nesting habitat is found, the activity may occur. If suitable nesting habitat is found within 1.0 mile of the proposed activity, it will be surveyed for the presence of nesting spotted owls. If no nesting owls are found, the activity may occur. If nesting spotted owls are found within 1.0 mile of the proposed activity, the activity will not occur until after September 30, unless it is part of an emergency action as described below. When surveys for nesting spotted owls are conducted and no evidence of nesting is found, the results of those surveys will be considered adequate for the breeding season (year) in which they are conducted and the following breeding season (year) as well.

E. Emergency Activities: The following activities may need to be conducted on an emergency basis, and could occur, in rare instances, within the spotted owls nesting season:

- Removal of trees that threaten City facilities or pose a significant risk to human safety
- Removal of landslide debris
- Emergency replacement of culverts
- Emergency repair or replacement of power lines
- Emergency repair of roads needed for access to Dam 1, Dam 2, Headworks, or water conduits
- Emergency helicopter flights to assess damage to the Bull Run water supply facilities

These activities may occur without restrictions for spotted owls. However, in the unlikely event it is necessary to cut a tree containing an occupied spotted owl nest, the City will notify the U.S. Fish and Wildlife Service (USFWS) 24 hours in advance of cutting the tree.

Measure description continued on next page.

Measure W-1 continued

F. Protection of Known Nest Trees: The City will avoid cutting live or dead trees that support nests of the spotted owl. Cutting nest trees will occur only if the tree presents an imminent risk to human safety or reliable operation of the water supply and hydroelectric facilities. If cutting a tree must occur, the City will make every effort to cut the tree when the nest is not occupied.

7.7.2 Bald Eagle Measure

In 2007, the USFWS determined that the bald eagle population had recovered to the point that the species no longer warranted listing under the Endangered Species Act (USFWS 2007a). In preparation for the delisting, the USFWS developed the National Bald Eagle Management Guidelines (USFWS 2007b). These guidelines give landowners information on how to avoid disturbing bald eagles. The USFWS encourages adherence to these guidelines to ensure the bald eagle population is sustained (USFWS 2007b). Consequently, these guidelines serve as the basis for the bald eagle management measures in this HCP.

Measure W-2—Minimize Impacts to Bald Eagles: For the term of the HCP, the City will take the following steps to avoid or minimize impacts to bald eagles on all covered lands as described in Chapter 3:

A. Activities with Little or No Potential to Disrupt Nesting or Roosting Bald Eagles: The use and maintenance of facilities, roads and rights-of way on covered lands will have little or no adverse effect on bald eagles. All are well-established features to which nesting and roosting eagles will have become habituated. Routine maintenance represents a minimal increase in noise and human activity compared with regular use. The following activities will be allowed to occur on covered lands without restrictions for bald eagles:

- Operation, maintenance and repair of the water system as described in HCP Section 3.4.1, other than activities described in Items B through H below.
- Implementation of the habitat conservation, research and monitoring measures described in chapters 7 and 9 of this HCP, other than activities described in Items B through J below.
- Performance of incidental land management activities as described in Section 3.4.4 of this HCP, other than activities described in Items B through J below.
- Use of roads by vehicles and humans on foot
- Mowing and cutting of roadside brush
- Cleaning and maintenance of roadside ditches
- Grading of road surfaces
- Patching of asphalt road surfaces

Measure description continued on next page.

Measure W-2 continued

- Spot patching of other road surfaces
- Sealing of road surface cracks
- Application of chip seal to asphalt roads
- Maintenance of water bars and other road drainage features
- Cleaning and repair of road culverts
- Replacement (lasting seven days or less) of road culverts
- Replacement (lasting seven days or less) of bridges, and not involving pile driving or blasting
- Maintenance and repair of power lines
- Mowing of shrubs and small trees on power-line rights-of-way

B. Activities with the Potential to Disrupt Nesting Bald Eagles Within 660 feet: The following activities have the potential to disrupt nesting bald eagles 660 feet or more away:

- Replacement (lasting more than seven days) of road culverts
- Replacement (lasting more than seven days) of bridges
- Road reconstruction
- Use of pile drivers
- Operation of rock crushers
- Removal of trees from along the power lines in the rights-of-way

These activities may occur between September 1 and December 30 without restrictions for nesting bald eagles. If they occur between January 1 and August 31, the City will evaluate forest habitat within 660 feet of the proposed activity to determine whether it is suitable bald eagle nesting habitat. If no suitable nesting habitat is found, the activity may occur. If suitable nesting habitat is found within 660 feet of the proposed activity, it will be surveyed for the presence of nesting bald eagles. If no nesting bald eagles are found, the activity may occur. If nesting bald eagles are found within 660 feet of the proposed activity and the activity is visible from the nest, the activity will not occur until after August 31, unless it is part of an emergency action as described below. If the activity is not visible from the nest, it may occur up to 330 feet from the nest during the nesting season. When surveys for nesting bald eagles are conducted and no nests are found, the results of those surveys will be considered adequate for the breeding season (year) in which they are conducted and the following breeding season (year) as well.

Measure description continued on next page.

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C. Activities with the Potential to Disrupt Roosting Bald Eagles Within 330 feet: The following activities have the potential to disrupt bald eagles in communal winter night roosts within 330 feet:

- Replacement (lasting more than seven days) of road culverts
- Replacement (lasting more than seven days) of bridges
- Road reconstruction
- Use of pile drivers
- Operation of rock crushers
- Removal of trees along power-line rights of way
- Power-line and right-of-way maintenance
- Maintenance and repair of power lines (other than emergency repair)
- Mowing of shrubs and small trees from power-line rights-of-way
- Removal of trees along power-line rights of way

These activities may occur between March 16 and November 14 without restrictions for roosting bald eagles. They may also occur from one hour after sunrise until one hour before sunset from November 15 through March 15 without restrictions for roosting bald eagles. If they occur from one hour before sunset until one hour after sunrise from November 15 through March 15, the City will evaluate forest habitat within 330 feet of the proposed activity to determine whether it is suitable habitat for bald eagle communal night roosting. If no suitable roosting habitat is found, the activity may occur. If suitable communal roosting habitat is found within 330 feet of the proposed activity, it will be surveyed for the presence of roosting bald eagles. If no roosting bald eagles are found, the activity may occur. If roosting bald eagles are found within 330 feet of the proposed activity, the activity will not occur from one hour before sunset until one hour after sunrise until after March 15, unless the activity is part of an emergency action, as described below. When surveys for roosting bald eagles are conducted and no roosts are found, the results of those surveys will be considered adequate for the roosting season (winter) in which they are conducted and the following roosting season (winter) as well.

D. Activities with the Potential to Disrupt Nesting Bald Eagles Within 1,000 feet: The following activity has the potential to disrupt nesting bald eagles within 1,000 feet:

- Use of aircraft at altitudes of 1,000 feet above the tree line

This activity may occur between September 1 and December 30 without restrictions for nesting bald eagles. If it occurs between January 1 and August 31, the City will evaluate forest habitat within 1,000 feet of the proposed activity to determine whether it is suitable bald eagle nesting habitat. If no suitable nesting habitat is found, the activity may occur. If suitable nesting habitat is found within 1,000 feet of the proposed

Measure description continued on next page.

Measure W-2 continued

activity, it will be surveyed for the presence of nesting bald eagles. If no nesting bald eagles are found, the activity may occur. If nesting bald eagles are found within 1,000 feet of the proposed activity, the activity will not occur until after August 31 unless the activity is part of an emergency action as described in subsection H below. When surveys for nesting bald eagles are conducted and no nests are found, the results of those surveys will be considered adequate for the breeding season (year) in which they are conducted and the following breeding season (year) as well.

E. Activities with the Potential to Disrupt Roosting Bald Eagles Within 1,000 feet: The following activity has the potential to disrupt bald eagles in communal winter night roosts within 1,000 feet:

- Use of aircraft at altitudes of 1,000 feet above the tree line

This activity may occur between March 16 and November 14 without restrictions for roosting bald eagles. It may also occur from one hour after sunrise until one hour before sunset from November 15 through March 15 without restrictions for roosting bald eagles. If it occurs from one hour before sunset until one hour after sunrise from November 15 through March 15, the City will evaluate all forest within 1,000 feet of the proposed activity to determine whether it is suitable habitat for bald eagle communal night roosting. If no suitable roosting habitat is found, the activity may occur. If suitable communal roosting habitat is found within 1,000 feet of the proposed activity, it will be surveyed for the presence of roosting bald eagles. If no roosting bald eagles are found, the activity may occur. If roosting bald eagles are found within 1,000 feet of the proposed activity, the activity will not occur from one hour before sunset until one hour after sunrise until after March 15, unless the activity is part of an emergency action as described in subsection H below. When surveys for roosting bald eagles are conducted and no roosts are found, the results of those surveys will be considered adequate for the roosting season (winter) in which they are conducted and the following roosting season (winter) as well.

F. Activities with the Potential to Disrupt Nesting Bald Eagles Within 0.5 Mile: The following activity has the potential to disrupt nesting spotted owls within 0.5 mile:

- Blasting

This activity may occur between September 1 and December 30 without restrictions for nesting bald eagles. If it occurs between January 1 and August 31, the City will evaluate all forest within 0.5 mile of the proposed activity to determine whether it is suitable bald eagle nesting habitat. If no suitable nesting habitat is found, the activity may occur. If suitable nesting habitat is found within 0.5 mile of the proposed activity, it will be surveyed for the presence of nesting bald eagles. If no nesting bald eagles are found, the activity may occur. If nesting bald eagles are found within 0.5 mile of the proposed activity, the activity will not occur until after August 31 unless the activity is part of an emergency action as described in subsection H below. When surveys for nesting bald eagles are conducted and no nests are found, the results of those surveys will be

Measure description continued on next page.

Measure W-2 continued

considered adequate for the breeding season (year) in which they are conducted and the following breeding season (year) as well.

G. Activities with the Potential to Disrupt Roosting Bald Eagles Within 1.0 Mile: The following activity has the potential to disrupt bald eagles in communal winter night roosts within 1.0 mile:

- Blasting

This activity may occur between March 16 and November 14 without restrictions for roosting bald eagles. It may also occur from one hour after sunrise until one hour before sunset from November 15 through March 15 without restrictions for roosting bald eagles. If it occurs from one hour before sunset until one hour after sunrise from November 15 through March 15, the City will evaluate all forest within 1.0 mile of the proposed activity to determine whether it is suitable habitat for bald eagle communal night roosting. If no suitable roosting habitat is found, the activity may occur. If suitable communal roosting habitat is found within 1.0 mile of the proposed activity, it will be surveyed for the presence of roosting bald eagles. If no roosting bald eagles are found, the activity may occur. If roosting bald eagles are found within 1.0 mile of the proposed activity, the activity will not occur from one hour before sunset until one hour after sunrise until after March 15, unless the activity is part of an emergency action as described below. When surveys for roosting bald eagles are conducted and no roosts are found, the results of those surveys will be considered adequate for the roosting season (winter) in which they are conducted and the following roosting season (winter) as well.

H. Emergency Activities: The following activities may need to be conducted on an emergency basis:

- Removal of trees that threaten City facilities or pose a significant risk to human safety
- Removal of landslide debris
- Emergency replacement of culverts
- Emergency repair or replacement of power lines
- Emergency repair of roads needed for access to Dam 1, Dam 2, Headworks, or water conduits
- Emergency helicopter flights to assess damage to the Bull Run water supply facilities

These activities may occur without restrictions for bald eagles. However, in the unlikely event that it is necessary to cut a tree containing a bald eagle nest, the City will notify USFWS 24 hours prior to cutting the tree.

I. Protection of Known Nest Trees: The City will avoid cutting live or dead trees that support nests of the bald eagle. Cutting nest trees will occur only if the tree presents an imminent risk to human safety or reliable operation of the water supply and hydroelectric facilities. If cutting a tree must occur, the City will make every effort to cut the tree when the nest is not occupied.

Measure description continued on next page.

Measure W-2 continued

J. Protection of Known Roost Trees: The City will avoid cutting live or dead trees that are used as communal winter night roosts by the bald eagle. Cutting roost trees will occur only if the tree presents an imminent risk to human safety or reliable operation of the water supply and hydroelectric facilities. If cutting a tree must occur, the City will make every effort to cut the tree when the communal winter roost is not occupied.

7.7.3 Fisher Measure

The City does not anticipate any impacts to the fisher during the term of the HCP because fishers have not been found in the Sandy River Basin. However, the City developed a contingency habitat conservation measure in case the fisher is found in the Basin during the term of the HCP.

Measure W-3—Minimize Impacts to Fishers: If the fisher is found to occur within 30 miles of the Bull Run watershed, or the locations of any unfinished HCP measures, the City will meet with USFWS to discuss whether any steps need to be taken to avoid or minimize impacts to fishers during the performance of the covered activities.